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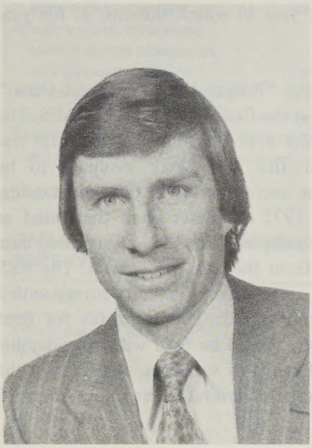
FARM DEBT IN CANADA



A.S. Brunst*

The average value of agricultural debt outstanding in Canada doubled from $4.2 billion in 1970 to $8.5 billion in 1976. The percentage share provided by major lenders also changed during this period, especially that provided by chartered banks, which increased from 28.5 percent in 1970 to 35.5 percent in 1976. The percentage distribution of the total debt by province has remained fairly constant. There has been a marked difference by province, however, in the rate of increase in the capital value of farmland and buildings over the period. Consequently, farm debt-investment ratios, as measured by the debt outstanding as a percent of the capital value of farm real estate, machinery and livestock have shown considerable variability at the provincial level during this period.

INTRODUCTION

The market value of farm capital in Canada was estimated at $57 billion in the 1976 Census of Agriculture, an increase of 137 percent from the 1971 Census findings.[1] Not surprisingly, the average value of agricultural debt outstanding has also shown a substantial increase during this period (1971-76), increasing from $4.5 to $8.5 billion, about 89 percent. Dividing the total debt outstanding in 1976 by the 338,578 farms listed in the 1976 Census of Agriculture gives an average farm debt of $25,100.

This paper, which presents statistics on agricultural debt outstanding by province to stimulate further research, begins with a detailed account of the methodological concepts used in building the series. The percentage share of farm debt by a grouping of the major lender sources, the percentage distribution of debt by province and farm debt-investment ratios are then discussed.

METHODOLOGICAL CONCEPTS USED IN BUILDING THE DEBT SERIES

The average annual values of agricultural debt outstanding by province and sources of major lenders for 1970-76 are listed in Table 4. The use of "average annual" and "debt outstanding" together might appear incongruous, because debt outstanding generally refers to a specific point in time. There are three reasons for not following the accepted reporting practice.

First, the debt series was developed as a by-product of the estimation of farm operating expenses for interest on indebtedness. The method used for estimating interest costs basically involved determining an average, annual debt-outstanding figure and applying an estimated, average weighted interest rate for each agricultural loan organization or source.

Second, it was thought that the relationship between debt outstanding and farm operating expenses for

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[1] Throughout this paper, any estimates quoted from the 1971 or the 1976 Census of Agriculture refer to all farms or agricultural holdings of one acre or more with sales of agricultural products during the year 1970, or 1975 in the case of the 1976 Census, of $50.00 or more.

interest charges would be useful for research purposes. An example is the analysis of the average, weighted interest rate by province.[2]

Finally, it is difficult to collect debt outstanding data for one specific date. The end of the fiscal year can vary from lender to lender, and in some cases, data on debt outstanding other than at the end of the fiscal year are not readily available. In addition, statistics on some sources of farm loans or credit come from multipurpose surveys such as the Agriculture Enumerative Survey (AES) of Statistics Canada, and it is unwise to use a reference date for debt questions that does not fall within the survey interview period because of memory bias problems. Given these complications in reaching a common reference date, the concomittant "arbitrary adjustments" that would in any event be required for some of the data if a specific date were used, and the fact that the data on certain loan sources, e.g., private individuals, are much less reliable than that from other sources, e.g., the Farm Credit Corporation (FCC), an "average annual" approach was preferred. Furthermore, "average annual" implies something less precise, when referring to debt outstanding, than a value at a specific point in time.

The method used in calculating the average annual value of outstanding debt varied according to lending organization or source and included some arbitrary assumptions. In the case of the category "Chartered Banks including Farm Improvement Loan Act (FILA) Loans", the average of the outstanding debt at the end of each of the calendar year quarters was taken. In the category "Federal and Provincial Government Agencies" the FCC average outstanding debt, which accounted for the majority of the debt in this category through 1970-76, was calculated in the same manner as that for chartered banks. The FCC and chartered banks, including FILA loans, together contributed more than 50 percent of the total debt outstanding in each of the years 1970-76. For the remainder of the "Federal and Provincial Government Agencies" category and for the "Credit Unions, Insurance, Trust and Loan Companies and Treasury Branches" category, other methods were used in cases for which quarterly data were not readily available. The most common method was to assume that the debt outstanding at the end of the fiscal year, usually March 31, was representative of the average debt during the calendar year in which the end of the year fell.

The estimates for the "Private Individuals and Other" category are based on the findings of the 1975 AES. The reference date for the debt questions on the AES was July 1, 1975 and the data were assumed to be representative of the average value of debt outstanding during 1975. The 1975 estimates were then used as benchmark data to make estimates based on trend data back to 1970 and from then to the present. The AES was a multipurpose area frame probability survey with a sample size of about 8,000. The estimates for debt outstanding, however, should be used with considerable caution as the coefficients of variation, especially at the provincial level, were in several cases more than 20 percent.

An attempt was made to exclude loans to farmers for non-farm business purposes, i.e., personal use loans. Loans for household purposes, when identified, were excluded, and in the case of loans for cars, an arbitrary one half of the value of debt outstanding was included as a farm loan. Finally, no consideration was given to amounts outstanding due to late payment of property or income tax.

DEBT DISTRIBUTION BY MAJOR LENDING SOURCE

While agricultural debt outstanding in Canada increased 100 percent between 1970 and 1976, outstanding debt from the chartered banks grew even more quickly, 149 percent. Figures for the proportion of agricultural debt provided by each of the four lending source categories in Canada for 1970, 1973 and 1976 are in Table 1. The chartered banks' share of total agricultural debt outstanding increased from 28.5 percent in 1970 to 35.5 percent in 1976, while the share of federal and provincial government agencies decreased from 40 to 34.4 percent. Together these two sources (banks and governments) have continued to provide about 70 percent of all agricultural loans.

The rapid increase in the value of farm loans by chartered banks, shown by the outstanding debt increase from $1,212 million in 1970 to $3,023 million in 1976,

[2] The current estimates in the "interest on indebtedness" series that is a component of the "farm operating expense" series included in the publication Farm Net Income, Annual, Catalogue No. 21-202, are not reconcilable with the debt outstanding series presented here. Major revisions will be introduced to the interest series based on the work which produced these debt outstanding estimates as a by-product. It is expected that these revisions will be incorporated in the 1977 Farm Net Income edition. Until such time as they are made, however, any analyses to determine average weighted interest rates by province or any other studies involving the relationship of these two series could prove misleading.

TABLE 1. PERCENT SHARE OF AGRICULTURAL DEBT OUTSTANDING BY MAJOR LENDER SOURCES IN CANADA

Source	1970	1973	1976
Chartered banks, including FILA loans	28.5	34.4	35.5
Federal and provincial government agencies	40.4	35.5	34.4
Credit unions, insurance, trust and loan companies and treasury branches	6.2	9.4	9.2
Private individuals and others[a]	24.9	20.7	20.9

[a]Includes supply companies, finance companies, dealers, stores and other unclassified credit sources.

was directly related to revisions to the 1967 Bank Act. The removal of loan interest rate ceilings and the provisions which allowed chartered banks to enter the field of first mortgage security made agricultural loans much more appealing to the banks. The trend to line-of-credit financing, which tends to encourage farmers to consolidate their financing, has also been responsible for the increased share of total outstanding debt by the banks in recent years. Chartered banks will likely play an even more important role in farm lending as a result of this trend and the anticipated growth in their computerized farm-accounting services.

TABLE 2. PERCENT DISTRIBUTION OF AGRICULTURAL DEBT BY PROVINCE

Province	1970	1973	1976
Prince Edward Island	0.8	0.7	0.6
Nova Scotia	0.9	1.0	0.9
New Brunswick	1.0	0.9	0.9
Quebec	12.6	11.6	11.8
Ontario	27.4	27.0	26.9
Manitoba	8.7	8.9	8.6
Saskatchewan	19.5	20.0	20.1
Alberta	21.5	22.6	22.2
British Columbia	7.6	7.3	8.0

DEBT DISTRIBUTION BY PROVINCE

Agricultural debt outstanding in Canada increased 100 percent between 1970-1976. Despite some provincial variation in the growth rate of debt, however, the distribution of total agricultural debt outstanding by province remained remarkably constant during this period. Table 2 shows that excepting Alberta, which had a 1.1-percent change between 1970 and 1973, no province gained or lost more than a 1-percent share of total outstanding debt. Furthermore, the distribution of outstanding debt by province for each of the major lending source categories also stayed fairly constant.

TABLE 3. RATIO OF FARM DEBT AS A PERCENT OF FARM INVESTMENT, BY PROVINCE

Province	1971			1976		
	Farm Investment[a]	Farm Debt[b]	Farm Debt-Investment Ratio	Farm Investment[a]	Farm Debt[b]	Farm Debt-Investment Ratio
	– mil. $ –		– % –	– mil. $ –		– % –
Prince Edward Island	161.9	34.8	21.5	326.5	52.5	16.1
Nova Scotia	206.1	43.4	21.1	446.8	75.1	16.8
New Brunswick	173.2	42.7	24.7	347.8	72.5	20.8
Quebec	2,200.3	551.1	25.0	4,196.5	1,001.8	23.9
Ontario	6,897.5	1,225.4	17.8	16,973.1	2,298.5	13.5
Manitoba	2,055.6	396.4	19.3	4,534.8	730.3	16.1
Saskatchewan	5,492.1	879.5	16.0	12,706.7	1,712.6	13.5
Alberta	5,242.1	982.5	18.7	13,861.6	1,896.5	13.7
British Columbia	1,606.9	337.2	21.0	3,589.8	678.4	18.9
Canada[c]	24,035.7	4,493.1	18.7	56,983.6	8,518.2	14.9
United States[d]	273,030	54,484	19.9	517,756	90,640	17.5

[a]Investment, as of June 1, in farm real estate, machinery and livestock based on Census of Agriculture data for agricultural holdings of one acre or more with sales of agricultural products during the reference year of $50 or more.
[b]Average value of farm debt outstanding.
[c]Excludes Newfoundland, Yukon and Northwest Territories.
[d]Figures refer to January 1 for investment in farm real estate, machinery and livestock.

Source: Agricultural Finance Databook, annual series, September 1976, Division of Research and Statistics, Board of Governors of the Federal Reserve System, Washington, D.C.

TABLE 4. AVERAGE ANNUAL AGRICULTURAL DEBT[a] OUTSTANDING BY SOURCE OF LENDERS ($ ' 000)

Source of Lender	Canada[c]	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
					1970					
Chartered banks including FILA loans[b]	1,212,000	10,908	7,272	9,696	60,600	369,660	106,656	239,976	339,360	67,872
Federal and provincial government agencies	1,723,583	18,569	27,022	21,734	296,323	371,489	179,468	366,403	358,169	84,406
Credit unions, insurance, trust and loan companies and treasury branches	264,111	863	933	2,585	38,100	26,058	24,061	89,110	69,663	12,738
Private individuals and others[d]	1,059,327	3,250	4,202	7,056	141,654	397,869	61,785	137,146	148,675	157,690
Total	4,259,021	33,590	39,429	41,071	536,677	1,165,076	371,970	832,635	915,867	322,706
					1971					
Chartered banks including FILA loans[b]	1,388,000	12,000	9,000	11,000	69,000	423,000	122,000	275,000	389,000	78,000
Federal and provincial government agencies	1,766,447	19,189	29,279	22,045	298,979	381,604	185,917	374,292	366,395	88,747
Credit unions, insurance, trust and loan companies and treasury branches	287,598	399	912	2,607	42,110	24,498	27,274	95,728	79,603	14,467
Private individuals and others[d]	1,051,015	3,248	4,180	7,035	141,002	396,303	61,255	134,493	147,463	156,036
Total	4,493,060	34,836	43,371	42,687	551,091	1,225,405	396,446	879,513	982,461	337,250
					1972					
Chartered banks including FILA loans[b]	1,458,000	14,000	10,000	12,000	76,000	462,000	130,000	296,000	384,000	74,000
Federal and provincial government agencies	1,813,287	19,239	31,276	23,074	306,390	390,193	198,710	380,748	371,717	91,940
Credit unions, insurance, trust and loan companies and treasury branches	350,219	505	1,161	3,078	52,483	30,697	32,047	114,333	97,481	18,434
Private individuals and others[d]	1,070,277	3,402	4,277	7,410	144,991	407,203	62,175	130,333	150,371	160,115
Total	4,691,783	37,146	46,714	45,562	579,864	1,290,093	422,932	921,414	1,003,569	344,489
					1973					
Chartered banks including FILA loans[b]	1,799,000	14,000	12,000	13,000	92,000	554,000	156,000	366,000	502,000	90,000
Federal and provincial government agencies	1,850,969	18,551	32,584	24,255	315,185	398,856	202,831	391,138	373,208	94,361
Credit unions, insurance, trust and loan companies and treasury branches	493,177	567	1,106	2,810	70,790	35,562	41,441	162,405	158,694	19,802
Private individuals and others[d]	1,084,323	2,963	4,284	6,098	126,140	425,743	64,039	126,555	150,622	177,879
Total	5,227,469	36,081	49,974	46,163	604,115	1,414,161	464,311	1,046,098	1,184,524	382,042

TABLE 4. AVERAGE ANNUAL AGRICULTURAL DEBT[a] OUTSTANDING BY SOURCE OF LENDERS ($ ' 000)

Source of Lender	Canada[c]	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
					1974					
Chartered banks including FILA loans[b]	2,119,000	16,250	14,250	15,500	102,750	634,500	178,250	412,500	622,750	122,250
Federal and provincial government agencies	2,187,631	19,487	35,631	26,681	359,808	489,572	222,244	466,611	453,521	114,076
Credit unions, insurance, trust and loan companies and treasury branches	615,152	517	980	3,933	79,270	36,133	57,068	204,998	205,114	27,139
Private individuals and others[d]	1,278,703	3,852	5,081	8,255	157,610	498,765	74,742	146,618	178,985	204,795
Total	6,200,486	40,106	55,942	54,369	699,438	1,658,970	532,304	1,230,727	1,460,370	468,260
					1975					
Chartered banks including FILA loans[b]	2,463,250	20,500	17,000	20,250	118,500	724,250	223,250	475,000	698,500	166,000
Federal and provincial government agencies	2,573,541	21,880	41,853	31,197	439,221	580,927	246,323	544,384	538,427	129,329
Credit unions, insurance, trust and loan companies and treasury branches	683,893	480	661	4,245	112,480	35,896	57,265	228,257	217,660	26,949
Private individuals and others[d]	1,621,348	5,018	6,472	10,808	198,372	637,473	94,487	181,602	227,230	259,886
Total	7,342,032	47,878	65,986	66,500	868,573	1,978,546	621,325	1,429,243	1,681,817	582,164
					1976					
Chartered banks including FILA loans[b]	3,023,000	22,500	19,000	22,250	140,500	874,250	297,000	605,500	820,500	221,500
Federal and provincial government agencies	2,930,765	23,958	48,427	36,605	511,461	684,731	258,528	625,232	602,067	139,756
Credit unions, insurance, trust and loan companies and treasury branches	781,006	514	582	1,702	131,700	38,327	70,815	282,087	224,028	31,251
Private individuals and others[d]	1,783,475	5,526	7,137	11,899	218,173	701,222	103,949	199,744	249,953	285,872
Total	8,518,246	52,498	75,146	72,456	1,001,834	2,298,530	730,292	1,712,563	1,896,548	678,379

[a] An attempt has been made to exclude loans to farmers which were not for farm business purposes.

[b] In the case of chartered banks and the FCC, the average of the outstandings at the end of each of the four calendar year quarters was taken. In cases where quarterly data were not available, other methods were used, the most common of which was to assume that the outstandings as at the end of the fiscal year, usually March 31, were representative of the average outstandings during the year.

[c] Excluding Newfoundland, Yukon and Northwest Territories.

[d] Includes supply companies, finance companies, dealers, stores and other unclassified credit sources.

Sources: Bank of Canada Review (various issues).
Farm Credit Corporation.
Various provincial government lending agencies.
Dr. R.S. Rust, "Farm Finance", Canadian Farm Economics, Vol. 11, No. 6, 1976.

TABLE 5. CAPITAL VALUE OF FARM REAL ESTATE, MACHINERY AND LIVESTOCK ($ ' 000)

Province	Land and Buildings			Machinery and Equipment			Livestock			Total Capital Value		
	1971	1976	% change	1971	1976	% change	1971	1976	% change	1971[a]	1976	% change
Prince Edward Island	102,090	218,194	113.7	38,273	75,181	96.4	21,511	33,106	53.9	161,894	326,481	101.7
Nova Scotia	132,233	321,033	142.8	39,868	76,669	92.3	33,963	49,131	44.7	206,085	446,833	116.8
New Brunswick	106,607	232,356	118.0	40,600	80,632	98.6	25,980	34,807	34.0	173,212	347,795	100.8
Quebec	1,321,792	2,717,656	105.6	427,538	862,673	101.8	450,708	616,146	36.7	2,200,284	4,196,475	90.7
Ontario	5,183,419	13,822,338	166.7	890,037	1,940,182	118.0	823,702	1,210,593	47.0	6,897,524	16,973,113	146.1
Manitoba	1,374,239	3,208,064	133.4	411,471	959,736	133.2	269,781	366,986	36.0	2,055,619	4,534,786	120.6
Saskatchewan	3,868,089	9,297,757	140.4	1,026,494	2,575,219	150.9	597,262	833,700	39.6	5,492,079	12,706,676	131.4
Alberta	3,530,252	10,627,528	201.0	867,446	2,110,053	143.2	844,161	1,124,064	33.2	5,242,097	13,861,645	164.4
British Columbia	1,293,261	3,051,563	136.0	163,173	346,525	112.4	150,429	191,754	27.5	1,606,924	3,589,842	123.4
Canada[b]	16,911,982	43,496,489	157.2	3,904,900	9,026,870	131.2	3,217,497	4,460,287	38.6	24,035,718	56,983,646	137.1

[a]Totals may not add across due to rounding.
[b]Excludes Newfoundland, Yukon, and Northwest Territories.

Source: 1976 Census of Agriculture for farms or agricultural holdings one acre or more with sales of agricultural products during the year 1975 (or 1970 in case of 1971 figures) of $50.00 or more.

FARM DEBT-INVESTMENT RATIO BY PROVINCE

The ratio of debt to investment gives an indication of the financial health of an enterprise or industry. While the ability to repay loans from anticipated cash flow would generally be judged the most important factor in evaluating loan applications or reviewing loans outstanding, the debt-investment ratio is also a useful factor to consider, especially in the event where the financial situation deteriorates to the point where assets have to be liquidated to meet debt payments. Certainly in these situations the lower the debt-investment ratio the greater the loan security.

Canadian farm debt as a percent of investment – taken as the market value of farm real estate, machinery and livestock – decreased from 18.7 percent in 1971 to 14.9 percent in 1976 (Table 3). These debt-investment ratios compare favorably with most non-farm businesses and also with U.S. farm debt-investment ratios. All provinces had reductions in the farm debt-investment ratios; the greatest was in Ontario, where the ratio went from 17.8 percent in 1971 to 13.5 percent in 1976. Quebec, which had the highest ratio in 1971 of 25 percent, continued to have the highest in 1976 with 23.9 percent, and had the smallest decrease of all the provinces.

Farm debt-investment ratios declined because the market value of farmland and buildings, machinery and livestock increased at a greater rate, 137 percent, than farm debt which increased 89 percent during 1971-76. In Quebec, the market value increased at the slowest rate, 91 percent, of all provinces during this period; this probably explains why Quebec also showed the smallest decrease in debt-investment ratio.

The capital value of farm real estate, machinery and livestock, by province, for 1971 and 1976 and the percent increase for each component between the two years are in Table 5. Although there were additions to the capital stock of farm assets during these years, by far the largest part of the 137-percent increase in capital value was due to asset appreciation. The farm real estate component, which in 1976 accounted for more than 75 percent of total capital value, increased more rapidly, 157 percent, than the machinery and livestock components.

The farm real estate component is composed of the market value of farmland and buildings. Farm building

replacement costs increased 72 percent during 1971-76.[3] This fact combined with the generally accepted belief that the market value of farm buildings increased at a lesser rate than the farmland market value between 1971 and 1976 suggests that building appreciation was the major factor in the market value increase of farm buildings.

Data from the 1976 Census of Agriculture show that between 1971 and 1976 total farmland decreased 0.4 of 1 percent and improved land (includes cropland, pasture, summer fallow and other) increased 1 percent. Hence the market value increase of farmland during this period was not due to increased acreages or to any great extent, fundamental quality changes. Quality changes due to improved drainage, irrigation and cultivation practices, etc., have certainly occurred; but these improvements would have contributed only a modest proportion of the increase in land values.

It is clear, therefore, that the main cause for the market value increase of farm real estate was asset appreciation. From this it can also be concluded that an important reason for the decline in farm debt-investment ratios between 1971 and 1976 was the appreciation of farm real estate.

CONCLUSIONS

Canadian chartered banks increased their share of total farm debt outstanding from 28.5 percent in 1970 to 35.5 percent in 1976, and this trend will likely continue for some time.

The average value of agricultural debt outstanding increased a substantial 89 percent during 1971-76. Over the same period, however, there was an even more important appreciation in the value of farm real estate. Consequently, farm debt-investment ratios declined to 14.9 percent in 1976, which indicates that farm loans, when taken as a whole, are well secured in Canada. It would be interesting, however, to have a breakdown of debt-investment ratios based on the number of years operators have been farming. For example, the ratios for full-time farmers who were in business less than five years would provide a good insight on the degree of financing necessary for beginning farmers.

Other areas that might warrant study include a breakdown of debt outstanding between that secured by real estate mortgages or agreements for sale and all other debt outstanding, and an analysis of averaged weighted provincial interest rates for each of these two categories. Further research into farm debt-investment or debt-equity ratios would also be useful, especially with regard to comparisons with other sectors. In doing this, it might be best to adopt the method used by Dr. R.S. Rust to account for other investments, e.g., cash, bonds, household furnishings, etc.[4] This approach assumes that farm real estate, machinery and livestock account for 90 percent of total farm investment and that other investments constitute the remaining 10 percent.

The distribution by province of total agricultural debt remained remarkably constant during 1970-76. Given the provincial variability in increases in market value of farm assets during this period, there does not appear to be a strong relationship between these variables. Perhaps studies to investigate the relationship between debt outstanding and farm net incomes, cash receipts, other variables or combinations might establish meaningful relationships. It is also possible, however, that this phenomenon is partly due to lending policies in some cases aimed at keeping provincial distribution of debt outstanding at fairly constant levels.

Finally, these statistics of average value of agricultural debt outstanding provide a key component, previously missing, in the establishment of the rudimentary provincial "balance sheet" of the farming sector.

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[3] Statistics Canada, Farm Input Price Index, Catalogue No. 62-004, quarterly.

[4] Rust, R.S., "Farm Finance", Canadian Farm Economics, Vol. 11, No. 6, 1976.

BUSINESS ORGANIZATION AND GROWTH PATTERNS OF FARMS IN SASKATCHEWAN

L.M. Johnson*

This paper uses data from a personal questionnaire study to describe the nature and characteristics of 59 Saskatchewan farms. Information was obtained about farm business organizations and operators, farm growth patterns, operators' plans, off-farm work, other business interests and some buying practices. The author believes that this information might be useful to people concerned with farm structure and the adjustment process.

INTRODUCTION

A family-controlled farm is similar to any other business in which an individual or several members of a family own a part or all of the assets and make the daily business decisions. Unlike the industrial-type business organization in which management is hired by stockholders, however, farm businesses are closely held; ownership and management are not separated and labor is mostly family-supplied.

Over the past few years there has been a trend towards fewer but larger farms. This has encouraged wide-scale mechanization. Larger and more sophisticated machines have increased capital requirements, decreased labor inputs but provided for a more efficient farm operation. Changes in farm size could be associated with shifts in tenure as well as in the farm organization. These shifts could likely have policy implications for agencies involved in farm credit, land banks, farm management and extension services, price support programs, production quotas and agri-business. The eventual policies adopted might act as barriers to this adjustment or could accelerate the process depending on the desired direction of this change.

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This paper describes the nature and characteristics of sample farms and their operators in a specified area of Saskatchewan. The data, which may provide more information with respect to the farm adjustment process, describe:

1. the nature of the farm business organization and operators in this area,
2. the growth patterns of farms and the future plans of the operators,
3. the farm debt structure and
4. the purchasing strategies of these farm operators.

Data Source and Study Area

The data were collected in a 1975 survey of 59 farms in census divisions 12 and 13 of west-central Saskatchewan. The sample was divided into three groups (Table 1); the large farms had 1,600 or more acres, medium farms between 760 and 1,599 and small farms 759 or less. Total acreage of all farms ranged from about 600 to 4,500 acres.

Through a personal questionnaire survey, information was obtained about farm business organizations and operators, farm growth patterns, operators' plans, off-farm work, other business interests and some buying

practices. A previous study, which presented budgets for these farms, indicated total resource requirements, production expenses, gross receipts, net returns and after-tax rates of return on equity for each size of operation.[1]

TABLE 1. 1975 SAMPLE FARMERS FARMING PRIOR TO 1951, IN 1960, IN 1970 AND IN 1975 BY SIZE-CLASS IN 1975

Year	Farm Size in 1975			Total Farms
	Small	Medium	Large	
	— number —			
Prior to 1951	6	8	7	21
1960	10	14	15	39
1970	15	19	20	54
1975	19	20	20	59

Source: Survey data.

In the section "Farm Growth and Tenure Patterns" of this paper, the farmers' memories in 1975 had to be relied upon to give data on changes on their farms as far back as 1951. Some readers may suggest it might be difficult to recall changes that far in the past. It is felt, however, that for major changes such as land acquisition the farmer's memory is quite accurate.

THE BUSINESS ORGANIZATION AND THE OPERATOR

Family businesses can be organized in three different ways. With sole proprietorship, the most common, an individual or a married couple is responsible for operating the business. Data in Table 2 show that all small farms were sole proprietorships, compared with 90 percent of the medium and 70 percent of the large. Eighty-six percent, i.e., 51 of the 59 sample farms, were sole proprietorships. The Census of Agriculture shows 90 percent of the farms in the study area as individual or family farms.

The partnership is the second most common form of organization for farm businesses. Five percent of the medium farms and 20 percent of the large or 9 percent of all farms were so organized. The 1976 Census of Agriculture indicates that 4 percent of the farms in the area involved partnerships. The partnership typically comprised a father and one or more sons, daughters, brothers or other close relatives. Each member contributed part of the capital, shared in the labor and management as well as earnings or losses in proportion to their contribution.

The third form of business organization is the corporation, which has a legal entity apart from its shareholders. Because of its separate legal identity, it can conduct business in the name of the firm. In a corporation, shareholders have limited liability, shares may be transferred, and it continues to exist even though one or more of the shareholders may die. Furthermore, the tax laws that apply to corporations differ from those that apply to sole proprietorships or partnerships. Only 5 percent of the medium and 10 percent of the large farms or 5 percent of all study farms were incorporated. The 1976 Census of Agriculture shows that 6 percent of the farms in the area were legally constituted companies.

Five percent of the small farms, 5 percent of the medium and 15 percent of the large had business interests other than farming (Table 2). These included an electrical shop, a hardware distributorship, a machinery

TABLE 2. BUSINESS ORGANIZATION AND PERSONAL INFORMATION ABOUT THE OPERATOR BY FARM SIZE, 1975

Item	Farm Size		
	Small	Medium	Large
	— percent —		
Types of Operation			
Sole proprietorship	100	90	70
Partnership	–	5	20
Corporation	–	5	10
Operators with Other Business Interests	5	5	15
Operators with Off-farm work	11	10	20
Operators' Personal Data			
Age groups – under 25	5	–	–
25-34	32	25	20
35-44	21	30	35
45-54	16	35	40
over 54	26	10	5
Years of education – under 9	37	10	20
9-11	32	15	25
12	26	65	45
university	5	10	10
Years on this farm – under 5	16	5	–
5-10	21	15	5
11-20	21	30	50
21-30	32	35	30
over 30	10	15	15
Place of residence – on farm	63	60	90
in town	37	30	10
both	–	10	–

Source: Survey data.

[1] L.M. Johnson, Canadian Farm Economics, Vol. 12, No. 3, June 1977.

dealership, a hairdressing shop and an apartment block. Eight of the 59 sample farms (14 percent) had off-farm work, which included telephone repairing, school busing, trapping, clerking and working in a bank.

Two each of the small- and medium-size operators had off-farm work with average earnings of $1,965 and $1,675. Four of the large operators did off-farm work, each earning an average of $3,025.

Data in Table 2 also give some personal information about the farm operator by farm size. Thirty-seven percent of the small-farm operators were under 35 years of age compared with 25 and 20 percent for the medium and large farms. Twenty-six percent of the small-farm operators were over 54 years, compared with only 10 percent of the medium and 5 percent of the large. Sixty-five percent of the medium-farm operators and 75 percent of the large were middle-aged (35-54 years); most of the small-farm operators, 63 percent, were either under 35 or over 54.

The small-farm operators generally had fewer years of education than larger-farm operators. For instance, only 31 percent of all small-farm operators had 12 or more years of formal education compared with 75 percent and 55 percent for the medium- and large-farm operators.

For the small-, medium- and large-farm operators under 35 years of age, 71 percent, 100 percent and 75 percent had 12 or more years of formal education. Of the small-farm operators between 35 and 54 years, only 14 percent had 12 or more years of formal education, compared with 62 percent and 53 percent of the medium- and large-farm operators. All of the small and large operators of 55 years or more had less than grade 12, but the medium-size operators in this age category had completed their twelfth grade.

Nearly 40 percent of the small operators had spent 10 years or less on their farms, compared with 20 percent of those on medium farms and only 5 percent of those on the large farms. Between 40 and 50 percent of all farm operators had farmed 21 years or more. Average time on the farm was 17 years, 20 years and 21 years for the small, medium and large operators.

About 60 percent of the small and medium operators lived on their farms all year in contrast to 90 percent of the large operators. Other operators lived either in town or spent parts of the year in both town and farm residences. Operators living in town were mostly younger or older, those with off-farm work and those with another business interest. Census data for 1976 show 22 percent of farmers not residing on the farm, whereas this study found the figure to be 25 percent.

FARM GROWTH AND TENURE PATTERNS

The 59 operators were questioned about past growth rates of their farming operations. Growth was measured by acreage increases in 1951-60, 1961-70 and 1971-75. Data in Table 3 indicate no distinct pattern in farm growth over successive periods by farm size. Rates in each growth period varied widely. For the farmers operating during the 1951-60 period, for example, the percentage increase in size was 14, 28 and 69 percent on the small, medium and large farms; in the 1961-70 period, small farms grew 48 percent, medium 40 percent and large 62 percent. Growth rates during each successive period apply to the size grouping of farms in 1975, irrespective of farm size during the period in question.

For operators who began farming before 1951 the percentage acreage increase between 1951 and 1975 was 79 percent for small farms, 130 for medium and 266 for large. Operators in these same size groups who started farming in the 1951-60 period increased their acreages by 58, 91 and 176 percent between 1961 and 1975. And the operators who began in 1961-70 increased their acreages by 17, 38 and 63 percent between 1971 and 1975. Hence, large farms grew at a considerably faster rate than the medium- and small-size farms.

During each successive period the average farm size generally increased through acreage expansion on the established farms and additions of new farms. The initial farm size of beginning farmers also increased with each successive period.

About one third of the operators in each size group farmed before 1951. At that time, the six small farms averaged 413 acres, the eight medium farms 715 acres and the 7 large farms 685 acres. By 1975, the 20 large farms had expanded to 2,640 acres, a 285-percent increase; the 20 medium farms to 1,549 acres, a 117-percent increase; and the 19 small to 720 acres, a 74-percent increase. The percentage increases in acreage during the 1971-75 period for all medium and large farms were 21 and 40 percent, considerably higher than the 3-percent increase on small farms.

It is difficult to explain the differences in the rates of farm growth or the time period of growth from the available information. There are several possible factors that could be responsible.

TABLE 3. SUMMARY OF AVERAGE FARM GROWTH AND TENURE PATTERNS ON SAMPLE FARMS, FOR THE PERIODS 1951-60, 1961-70 AND 1971-75, BY 1975 FARM SIZE

Commenced Farming	Number of Farms	Acres per Farm, 1951	Source of Land, 1951			Acres per Farm, 1961	Source of Land, 1961			Acres per Farm, 1971	Source of Land, 1971			Acres per Farm, 1975	Source of Land, 1975		
			Owned				Owned				Owned				Owned		
			Purchase	Gift	Rented		Purchase	Gift	Rented		Purchase	Gift	Rented		Purchase	Gift	Rented
— average acres per farm —																	
— Small Farms —																	
Prior to 1951	6	413	206	155	52	466	286	155	25	740	428	235	77	740	428	235	77
1951-60	4	—	—	—	—	480	360	120	—	760	560	120	80	760	560	120	80
1961-70	5	—	—	—	—	—	—	—	—	573	287	95	191	669	479	95	95
1971-75	4	—	—	—	—	—	—	—	—	—	—	—	—	715	475	79	161
All farms	19	413	206	155	52	472	316	141	15	700	427	157	116	720	479	141	100
— Medium Farms —																	
Prior to 1951	8	715	238	80	397	1,053	398	258	397	1,408	734	258	417	1,648	852	258	538
1951-60	6	—	—	—	—	731	552	179	—	1,178	792	179	207	1,393	926	179	288
1961-70	5	—	—	—	—	—	—	—	—	1,186	542	260	384	1,633	862	260	511
1971-75	1	—	—	—	—	—	—	—	—	—	—	—	—	a	a	a	a
All farms	20	715	238	80	397	915	464	224	227	1,277	702	234	342	1,549	858	222	469
— Large Farms —																	
Prior to 1951	7	685	594	91	—	1,301	1,004	91	206	2,094	1,568	91	434	2,507	1,878	91	538
1951-60	8	—	—	—	—	1,039	553	486	—	1,938	1,036	565	337	2,869	1,325	736	808
1961-70	5	—	—	—	—	—	—	—	—	1,506	1,124	223	159	2,458	1,760	223	475
1971-75	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
All farms	20	685	594	91	—	1,161	763	302	96	1,885	1,245	313	327	2,640	1,627	382	630

[a]Data omitted to protect confidentiality.

Source: Survey data.

1. Relatively favorable grain prices and resultant higher incomes during the 1970-75 period probably enabled the operators of medium and large farms to expand acreages more than the operators of small farms. Because of higher grain prices, land values increased and the operators of the larger farms with their higher incomes and easier access to credit were able to outbid the small-farm operators as land came up for sale. Between 1970 and 1975, small farms increased only 20 acres, whereas medium farms increased 272 acres and large farms 755 acres.
2. More small-farm operators began to farm later than the operators of larger farms. Nine small-farm operators started farming after 1961, compared with six medium and five large. The small operators had farmed for an average of 17 years, compared with 20 and 21 years for the medium and large. This allowed the latter groups a little more time to expand their operations.
3. Large-farm operators had more education than small-farm operators. This may have improved their capability to manage larger farm operations. Such capability, however, is not measurable.
4. The operator's age may have been a factor in farm expansion. Twenty-six percent of the small operators were over 55, compared with 10 percent of the medium and 5 percent of the large. Farmers in this older age group were probably thinking of retirement and not interested in enlarging their farms.
5. More of the larger farms were partnerships or corporations. They would have available more labor and managerial capacity than small farms, as well as easier access to farm credit – factors that generally favor farm expansion.

Other external factors such as general economic conditions, farm input and product prices, grain quotas or even the weather might have influenced the study farms' growth patterns.

Between 1951 and 1975, no important change in land tenure occurred on the small farms. At the beginning and end of the period, small-farm operators owned about 85 percent of the land and rented 15 percent.[2] Considerable tenure differences, however, were noted in the other two size groups. In 1951, medium-farm operators owned only 44 percent of the land and rented 56 percent. By 1975, they owned 70 percent and rented 30 percent. Large-farm operators owned all their land in 1951, but in 1975 owned 76 percent and rented the remaining 24 percent. For all survey farms, 75 percent of the land operated was owned and 25 percent rented. Census information for 1976 shows 70 percent of land in the study area as owned and 30 percent rented.

Eighty-seven percent of the land on small farms was owned in 1951, 57 percent being acquired through purchase and 43 percent by gift or inheritance. In 1975, 86 percent of the land was owned, 77 percent being purchased and 23 percent either gifted or inherited. On medium farms, 44 percent of the land was owned in 1951, 75 percent being acquired by purchase and 25 percent gifted or inherited. Seventy percent was owned in 1975, 79 percent being purchased and 21 percent gifted or inherited. All the land on large farms was owned in 1951, 87 percent being purchased and 13 percent gifted or inherited. By 1975, however, owned land accounted for only 76 percent of the total, 81 percent being purchased and 19 percent gifted or inherited.

Of the 59 operators, 22 or 37 percent indicated that they wished to continue expanding their operations. The proportion was much higher on the small farms, 68 percent, compared with 35 percent for medium and only 10 percent for large. Six of the 19 small operators, 32 percent, said they had no plans for further expansion and four had plans for retirement. Twelve of the 20 medium-farm operators, 60 percent, said that their farms would stay the same size and one wished to reduce his acreage. Five of the medium-farm operators, 25 percent, indicated retirement plans. Eighteen of the 20 large operators, 90 percent, had no plans for further expansion and three of them indicated plans for retirement. Most of the farmers thinking of retirement had sons who would join the operation and eventually take over.

Operators wishing to expand named several factors which might affect their growth plans, including credit availability and interest rates, grain prices, labor supply, land availability, land prices and government policies and programs.

DEBT STRUCTURE

Data on farm debt are shown in Table 4. Of the 59 operators visited, 33 or 56 percent reported some medium- or long-term debt or both. Long-term loans were mostly for 20 years or more, while the medium-term were for one to 10 years. The Farm Credit Corporation financed most of the long-term

[2] Owned land includes land acquired through purchase as well as gifts and inheritances.

TABLE 4. DEBT BY FARM SIZE, 1975

Type of Debt	Percent of Farms with Debt	Average Debt: Farms with Debt	Average Debt: All Farms
		— dollars per farm —	
		Small Farms	
Long-term	58	27,667	16,018
Medium-term	37	9,843	3,626
		Medium Farms	
Long-term	50	31,425	15,712
Medium-term	25	11,485	2,871
		Large Farms	
Long-term	35	34,429	12,050
Medium-term	25	14,100	3,525

Source: Survey data.

loans, which were nearly always land purchases. Medium-term loans were either bank or farm improvement loans usually for machinery. In some cases, a father had financed a son to buy both land and machinery.

BUYING STRATEGIES

It was felt that some differences might be found in the operator's purchasing strategies by farm size. Data in Table 5 present some of the input-buying practices. Major purchased inputs on the study farms included machinery, fertilizers, herbicides, pesticides, seeds and petroleum products. The only inputs for which farmers said they shopped around before buying were fertilizer and machinery. Eleven of the 59 farmers interviewed, 19 percent, compared prices for fertilizer and 35 of them, 59 percent, for machinery. More of the small-farm operators investigated prices for these inputs than either medium-or large-farm operators. Small-farm operators visited an average of 1.8 fertilizer dealers and 4.6 machinery dealers, while those with medium and large farms contacted 1.2 and 1.4 fertilizer dealers and 3.6 machinery dealers each.

Dealers in fertilizers, herbicides, pesticides, seeds and petroleum products were located, on the average, seven to 15 miles from the farmers' headquarters, except the

TABLE 5. BUYING STRATEGIES FOR DESIGNATED INPUTS BY FARM SIZE, 1975

Inputs and Farm Size	Compared Prices: Yes	Compared Prices: No	Dealers Visited	Average Distance[a]	Contract: Yes	Contract: No
	— percent —		— No. —	— miles —	— percent —	
Fertilizer						
Small	32	68	1.8	11	68	32
Medium	10	90	1.2	10	85	15
Large	15	85	1.4	15	90	10
Herbicides and Pesticides						
Small	—	100	1.1	10	11	89
Medium	—	100	1.2	11	35	65
Large	—	100	1.1	7	35	65
Seeds						
Small	—	100	1.0	12	—	100
Medium	—	100	1.0	13	—	100
Large	—	100	1.1	34	—	100
Petroleum Products						
Small	—	100	1.1	12	—	100
Medium	—	100	1.0	9	—	100
Large	—	100	1.0	8	—	100
Machinery						
Small	79	21	4.8	30	—	100
Medium	40	60	3.6	39	5	95
Large	60	40	3.6	34	5	95

[a]This is the average distance one way.
Source: Survey data.

large-farm group which travelled an average of 34 miles for seed purchases. This group average was greatly affected by one large operator, a registered seed grower, who travelled 155 miles to buy seed. Farmers usually compared prices more and travelled farther for machinery, averaging a distance of 30 to 39 miles.

The surveyed farmers were asked if they contracted when purchasing farm inputs. Forty-eight of the 59 operators, 81 percent, contracted for fertilizer and 16 of them, 27 percent, for herbicides and pesticides. Only two operators, 3 percent, contracted for machinery (Table 5). More medium and large operators used purchase contracts than small operators, perhaps indicating that they had established their dealer contacts. No survey farmer used contract buying for either seeds or petroleum products.

MACHINERY PURCHASES

It was believed that purchasing practices and the lifetime of machines would be somewhat different according to farm size. The sample farm operators were therefore asked about purchases of machinery and years of use (Table 6). Nearly half of the 59 operators said that their tractor or truck was new when they bought it. Sixty percent purchased new seed drills and over 70 percent bought new combines or tillage equipment. Other operators bought used equipment and some purchased both new and used.

Farm size affected buying practices. More large-farm operators bought new equipment than medium- or small-farm operators. For example, 70 percent of the large-farm operators purchased new tractors, compared with 30 and 39 percent of the medium- and small-farm operators, and 85 percent bought combines new compared with 80 and 50 percent of the medium- and small-farm operators. Trucks and other equipment had similar differences. Fifty percent of the large-farm operators purchased all equipment when new, compared with only 15 and 10 percent of the small- and medium-sized operators.

More larger-farm operators said that they bought new equipment to get bigger machines, minimize down time or increase their capital cost allowance. The larger farms probably had less down time because their outlay for machinery repairs was about $2.00 per cultivated acre compared with about $2.50 on the small farms. This conclusion is based on the assumption that lower repair costs indicate less time lost in the field.

TABLE 6. PERCENT OF FARMERS BUYING NEW AND USED MACHINES AND YEARS OF MACHINERY USE BY FARM SIZE

Item	Farm Size		
	Small	Medium	Large
	— percent —		
Tractors Purchased			
New	39	30	70
Used	44	10	–
New and used	17	60	30
Combines Purchased			
New	50	80	85
Used	28	15	10
New and used	22	5	5
Trucks Purchased			
New	37	45	65
Used	26	20	–
New and used	37	35	35
Drills Purchased			
New	35	50	90
Used	35	35	10
New and used	30	15	–
Tillage Equipment Purchased			
New	47	70	95
Used	21	5	–
New and used	32	25	5
	— years of use —		
Tractors			
Range	8-18	6-20	6-16
Average	11.5	12.9	10.8
Combines			
Range	5-15	6-15	5-15
Average	11.5	9.9	8.0
Trucks			
Range	9-15	6-20	5-15
Average	11.8	11.0	9.6
Drills			
Range	8-15	7-20	5-15
Average	11.2	12.2	10.2
Tillage Equipment			
Range	8-20	8-18	6-15
Average	12.1	11.0	10.7

Source: Survey Data.

The 59 operators indicated that the useful lifespan of tractors was 11.7 years, combines 9.7, trucks 10.7, seed drills 11.0 and tillage equipment 11.4. The anticipated lifespan for tractors on large farms was 10.8 years, compared with 12.9 on the medium and 11.5 on the small. Combine life expectancy was 11.5, 9.9 and 8.0 years for the small, medium and large farms; trucks were kept 11.8, 11.0 and 9.6 years. Larger-farm operators also expected fewer years of use from seed drills and tillage

equipment. Since large-scale farmers anticipated greater use of their equipment, they expected it to have a shorter lifetime.

SUMMARY

This personal questionnaire survey was designed to describe the characteristics of a sample of Saskatchewan farms for the information of people concerned with farm structure and the adjustment process.

Eighty-six percent of all sample farms were sole proprietorships, 9 percent were partnerships and 5 percent were incorporated. All small farms were sole proprietorships, compared with 90 and 70 percent for the medium and large farms.

Eight percent of the operators had business interests other than farming and 14 percent did off-farm work.

Small-farm operators generally had fewer years of formal education than larger-farm operators, had spent less time farming and more often lived in town.

Between 1951 and 1975, large farms expanded their acreage 285 percent, medium farms 117 percent and small farms 74 percent.

Medium and large farms have probably expanded more rapidly because the operators are somewhat younger, have higher incomes, more education, more experience, and more partnerships or incorporations.

In 1951, small-, medium- and large-farm operators owned 87, 44 and 100 percent of their land; in 1975, they owned 86, 70 and 76 percent. Between 1951 and 1975, therefore, the percentage of owned land remained about the same on the small farms, increased on the medium and decreased on the large.

Sixty-three percent of the small farm operators reported some debt, compared with 55 and 50 percent of the medium and large operators. Debt for all small-farm operators averaged \$19,644, somewhat higher than that of medium and large operators, whose average debts were \$18,583 and \$15,575. On the other hand, the data indicate that for those operators reporting debt, the highest average amount was recorded on the large farms followed by medium and small farms. Debt, however, could not be considered high on these study farms.

Of the five small-farm operators over 54 years of age only one reported debt. All of the seven small-farm operators under 35 years had debt that averaged \$43,538. None of the medium-size and only one of the large-size operators over 54 years reported debt. Three of the five medium-size operators under 35 years had debt for an average of \$21,920, whereas only one of the four large farmers in this age group reported debt. Hence it appears that credit agencies can and probably are directing their lending activities to the smaller and younger beginning farmers.

Data obtained on short-term debt, less than one year, were not adequate to be used in this analysis. In many instances the farmers stated that some bills were outstanding for such items as fuel, fertilizer, weed spray or other inputs but did not know the amount. They did not seem to regard these small short-term bills as debt but as a business convenience.

Sixty-eight percent of the small-farm operators planned to expand operations, compared with 35 percent of the medium and 10 percent of the large.

The farmers named credit availability, interest rates, land and grain prices, labor supply, land availability and government policies and programs as factors that could affect future growth patterns.

Average debt was \$19,644 for small farms, \$18,583 for medium and \$15,575 for large. More of the younger and small-farm operators reported debt and their debts were higher.

Farmers compared prices more and travelled farther for machinery than for any other crop input. More large-farm operators purchased new equipment than medium- or small-farm operators and half of the large-farm operators purchased all equipment new, compared with 15 and 10 percent for the small- and medium-size operators.

VARIATION IN CASH EXPENSES ON WESTERN GRAIN FARMS

The Western Grain Stabilization Program requires reliable annual estimates of the eligible receipts and expenses related to the six specified crops in the designated wheat area. It is relatively easy to obtain reliable estimates of cash receipts, but much more difficult to obtain reliable estimates of expenses. The author presents the results of a study aimed at improving the reliability of expense estimates in the framework of the WGSA.

*M.M. Sorboe**

INTRODUCTION

Agriculture in the Canadian west is geared to the production of cereal grain and oilseed crops in which wheat is predominant, and to livestock production in which beef plays a primary role. More than 80 percent of the approximately 34 million tonnes of grain (wheat, barley, oats, corn and rye) produced annually in Canada from 1963 to 1976 were produced in the four western provinces. Wheat constituted more than half of the total cereal grain produced in Western Canada and Western Canada accounted for about 97 percent of all the wheat produced in the country. Production and exports vary each year, but about 75 percent of the wheat, 30 percent of the barley and 2 percent of the oats produced during the period 1963-74 were exported from Canada [1]. Rapeseed and flaxseed are also important in Western Canada's crop production and export trade.

Western grain producers compete in an international market which is characterized by substantial variation in prices and volumes of grain traded each year. Much of the variation is random and contributes to market uncertainty against which producers have limited means of protection. They are also exposed to significant uncertainty in production, as adverse planting and harvesting conditions have substantial effects on the volume of output and input costs.

Production and income statistics for the major crop commodities in the Prairie Provinces for selected years illustrate the variability of income and cash flow facing western farmers [2]. Total cash receipts from major crop sales in the Prairies rose from $799 million in 1949 to $1,255 million in 1967 and then declined to $750 million in 1970 (Table 1).

The relatively tight world wheat supply-demand situation which developed in the early 1970s subsequently caused prices to rise to unprecedented levels. This is reflected in the sharp increases in farm cash receipts of prairie grain producers in 1974 and 1975. More recently, with favorable yields and replenished stocks in the major grain producing countries, prices have decreased. This type of variation is likely to continue, providing that no artificial constraints are imposed.

The main objective of the federal Western Grain Stabilization Act (WGSA) passed in January 1976 is to minimize the effect of the fluctuations in the total net cash flow to the western grain-producing sector. It does not remove the necessity for individual producer crop

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insurance for protection against income loss due to crop failure. The plan allows for substitution among the six designated crops and should not interfere with the individual producer's responsibility of making planting decisions in line with expected real market returns.

TABLE 1. FARM CASH RECEIPTS FROM THE SALE OF MAJOR CROP COMMODITIES, PRAIRIE PROVINCES, SELECTED YEARS

Year	Wheat[a]	Oats	Barley	Oilseeds[b]	Total[c]
		– million dollars –			
Average					
1935-39	160	8	9	1.5	178.5
1949	664	55	61	19	799
1951	671	65	92	17	845
1956	513	52	112	61	738
1961	553	25	64	66	708
1966	975	35	100	107	1,217
1967	1,013	32	122	88	1,255
1968	946	26	114	59	1,145
1969	670	27	85	110	892
1970	443	15	136	156	750
1971	610	28	200	191	1,029
1972	890	27	212	210	1,339
1973	872	37	318	364	1,591
1974	1,713	47	536	471	2,767
1975	2,365	82	604	335	3,386
1976 (est.)[d]	1,937	79	531	275	2,822

Source: Selected Agricultural Statistics for Canada, Agriculture Canada, Economics Branch, Publication No. 76/10, June 1976, page 97.

[a]Includes Canadian Wheat Board payments and net cash advance payments.
[b]Includes flaxseed and rapeseed.
[c]Does not include rye.
[d]Agriculture Canada, Market Commentary, Canadian Agriculture Outlook Conference Report, December 1976, pages 78 to 84 inclusive.

Under the Act's terms, the difference between the current (calendar) year net cash flow (eligible cash receipts minus eligible cash expenses) and the previous five-year total average net cash flow will determine the amount of stabilization payment that will be shared by participating producers. The cash flows are associated with the six selected crops produced in the designated area.[1]

[1]The six specified crops are wheat, oats, barley, rye, flaxseed and rapeseed. The designated area includes Alberta, Saskatchewan, Manitoba, the Peace River Block of British Columbia and a small part of western Ontario.

Implementation and operation of the Western Grain Stabilization Program, therefore, requires reliable annual estimates of the eligible receipts and expenses pertaining to the six specified crops produced in the designated Wheat Board area. It is comparatively easy to obtain reliable annual estimates of the total eligible cash receipts of a region from Wheat Board permit books and company records. It is much more difficult to obtain reliable expense estimates for a region because they are derived from the expansion of farm sample statistics, which owe their credibility to the criteria used in sample design and selection, the accuracy with which the cost data are recorded and collected and the methodology used in allocating joint cash expenditures on multiple enterprise farms.

Objectives

Type of farm enterprise, size of farm operation and soil fertility are three quantifiable factors which significantly influence cash costs per unit of output.[2] They are, therefore, generally included in the criteria for farm sample selections which are designed for the establishment of input-output coefficients. Little is known, however, about the relationship between the above mentioned factors and eligible cash expenses per crop acre – the benchmark selected for estimating the area's eligible cash expenses under the WGSA.

This study reports the results of the first step in a multistage project concerned with developing criteria to be considered in subsequent sample selection, data collection and analysis leading to more accurate cash expense estimates for WGSA purposes. The specific objectives were as follows:

1. to evaluate the between-year variations in cash expenses per acre on groups of the same or similar grain and grain-livestock farms;

2. to test the significance of the within-year differences in cash expenses per crop acre among groups of farms differentiated by degree of crop enterprise specialization, size and soil-productivity level and

3. to determine what additional data should be obtained from farmers to improve the effectiveness of the data analysis phase in the entire project.

[2]Heady, E.O., Economics of Agricultural Production and Resource Use, pp. 349-369. Madden, J.P., Economics of Size in Farming.

Estimation Problems

Eligible cash expenses, defined by the WGSA, comprise outflows of the following selected variable and fixed expenditures:

1. property taxes on owned and rented land described in permit books and on buildings used for grain production;
2. items purchased by producers to operate and maintain farm machinery used for grain production or used in the farm business in respect of grain production and transportation;
3. items purchased by producers to maintain or improve the productivity of land used for grain production;
4. items purchased by producers to maintain farm buildings used for grain production, but not including items purchased to maintain a home;
5. the portion of the annual cost of purchased hydro and telephone services that is attributable to grain production;
6. insurance premiums for the protection of crops, machinery and buildings required in grain production;
7. small tools and miscellaneous hardware required for grain production;
8. services and work performed for producers that are attributable to grain production and
9. non-mortgage interest payments to reflect the short-term operating interest expense associated with grain production.

Eligible cash expenses are not confined to cash costs which are associated with the crops produced in a particular year. For example, if a two-year supply of fertilizer is purchased in a calendar year, all of the cash outlay is considered to be an eligible expense for that year.

Taxes on land (a fixed cost) may be only partially paid; the amount actually paid during the year is an eligible cash expense. Depreciation on buildings and equipment is not included because it is not a cash expense. Interest paid on mortgaged loans, although a cash expense, is not eligible because it is an expense associated with farm capital formation over time.

A continuing problem in enterprise expense analysis concerns the reliability of the results obtained from using different methods to allocate joint expenses on multiple enterprise farms. To the extent that the farm operator is the person most knowledgeable about his operation, enterprise expense studies based on farmer allocations of joint expenses are often assumed to be the most reliable estimates. Without the benefit of guidelines, however, farmer allocations of joint expenses are likely to be inconsistent because they are based on individual value judgments. For example, a share of tractor operating expenses can be allocated between livestock and grain production based on hours of use, estimated additional expense, ratio of crop acres devoted to livestock and grain enterprises or on the ratio of enterprise sales receipts. For the real changes to be reflected in the yearly net cash flows, it is important that the method or methods of allocation selected be used consistently over time.

THE STUDY

Data Source

This study was based on currently available data from a CANFARM probability sample of farms located in southwest Manitoba and southeast Saskatchewan, an area typical of the dark brown and black soils of the Parkbelt. Data were available for 110 farms in 1974, 117 in 1975 and 87 in 1976. The 87 farms for 1976 were represented in the 1974 and 1975 samples; similarly, the 110 farms included in the 1974 sample were represented in the 1975 sample.

Analytical Procedure

The procedure adopted for analyzing the three-year cash expense data included several steps.

Hypotheses were formulated concerning the functional relationship between cash expense per crop acre and the variables used in the sample design and selection. (Cash expense per crop acre is a function of enterprise specialization, farm size and soil-productivity level.) A machinery capital variable, although not included in the criteria for the sample selection, was included in the hypotheses to determine its influence on cash expense per acre. In algebraic form the relationship is as follows:

$Y = f(X_1\ X_2\ X_3\ X_4 \mid X_5 \ldots\ldots\ldots X_n)$, i.e., $X_5 - X_n$ held constant where

X_1 = degree of crop enterprise specialization,
X_2 = farm size in terms of crop acres operated,
X_3 = soil-productivity level in terms of tax assessment and
X_4 = machinery capital investment per crop acre.

A cash expense allocation procedure was applied from which wholly separable livestock expenses (livestock purchases, livestock supplies and services, twine, pasture rent and grazing fees) were excluded as non-eligible cash expenses. Also, the estimated taxes attributable to unimproved land were subtracted from the total land taxes to obtain the net eligible land tax expenses. The remaining eligible cash expenses were divided by the number of crop acres for each farm to obtain cash expense per crop acre.

Farms were classified into groups according to type, size and soil-productivity level on the following basis:

1. grain farms – more than 80-percent crop PMWU[3], grain-livestock farms – less than or equal to 80-percent crop PMWU;
2. large farms – more than 700 crop acres, small farms – less than or equal to 700 crop acres;
3. high soil-productivity farms – more than a selected tax assessment per crop acre based on the average tax assessment per acre for the sample farms in each year, low soil-productivity farms – less than the tax assessment of high soil-productivity farms. Municipal tax assessments which were based on the assessment values of land in Manitoba and Saskatchewan were used as criteria for the productivity classifications.

Tests for the normality of farm cash expense frequency distributions were carried out using the chi-square criterion $X^2 = \Sigma (f_i - F_i)^2/F_i$ at the 5-percent probability level with K-3 degrees of freedom.[4] Tests were conducted for each of the three years.

The hypothesis of equality of means and variances of paired farm groups differentiated by type of farm, size, and soil-productivity level was tested at the 95-percent confidence level for each of the three-year data sorts.

The cash expenses per acre of high soil-productivity and low soil-productivity farms were regressed on four independent variables, number of crop acres, ratio of crop to total productive work units, tax assessment per crop acre and machinery capital per crop acre. The purpose of the linear multiple regressions was to establish the strength of the relationships between cash expenses and certain identifiable variables. If the relationship was strong they could serve a useful role in estimating cash expenses for individual farms and for the region.

[3] A productive man work unit (PMWU) is the average amount of directly productive work accomplished by one man in an eight-hour working day. Source: Farm Management Data Manual, Alberta Department of Agriculture.

[4] Many of the standard statistical techniques, e.g., T-test and F-test, are based on the assumption of a normal distribution. If a distribution is found to be non-normal then non-parametric tests for equality of means give more reliable results.

TABLE 2. CASH EXPENSES PER CROP ACRE ADJUSTED FOR PRICE CHANGES (BASE YEAR 1974=100) FOR SOUTHWEST MANITOBA AND SOUTHEAST SASKATCHEWAN

Item	1974	1975	1976
Number of farms	110	116	87
Size (improved acres)	788	795	878
		– dollars per acre –	
Fertilizers	2.91	2.90	2.26
Spray materials	0.96	1.02	1.18
Fuel, oil and grease	2.62	2.74	3.01
Machinery repairs[a]	3.68	3.21	3.06
Crop insurance	0.48	0.48	0.63
Crop supplies[b]	0.82	1.00	1.62
Custom work	1.02	0.84	0.66
Hired labor	0.88	0.95	0.98
Building and fence repairs	1.94	1.45	1.50
Car expenses	0.71	0.76	0.90
Miscellaneous[c]	1.87	2.26	1.99
Land tax	1.29	1.43	1.82
Total cash expense	19.18	19.04	19.61

Source: CANFARM Probability Sample data.

[a] Includes machinery repairs, license and insurance cash expenditures.

[b] Includes seed purchases, seed cleaning and treating.

[c] Includes cash expenditures for electrical power, telephone, water, machinery rentals, tool purchases and other miscellaenous expenses.

Observations

A preliminary comparison of the group averages of cash expenses indicated that grain farms consistently had slightly lower expenses per crop acre than grain-livestock farms (Tables 4, 5 and 6). It was noted, however, that grain farms were on the average substantially larger than the grain-livestock farms and that large farms consistently had lower average total cash expenses per acre than small farms. From this it could be expected that if the sizes of grain and grain-livestock farms were comparable, their respective mean cash expenses per acre would tend to converge. High soil-productivity farms consistently had higher average per acre total cash expenses than low soil-productivity farms. In each of the three years the differences were substantial.

In current dollars, the average total cash expense per acre for all farms was $19.18 in 1974, $22.74 in 1975

and $25.36 in 1976. Between-year cash expense comparisons made after adjustments for price changes indicated that increased inputs per acre for fuel and crop expense items were offset by decreased inputs for other items (Table 2). This resulted in little change in the year-to-year total expense per acre in constant dollars.[5]

Table 3 shows the standard deviations and coefficients of variation for the total expenses per acre of the classified farm groups. In each of the three years, large farms had a lower coefficient of variation than small farms, and grain farms tended to have lower ones than grain-livestock farms. For all farms the increase in cash expenses, with little change in the standard deviation, caused the coefficient of variation to decrease from 52 percent in 1974 to 41 percent in 1976.

TABLE 3. RATIO OF THE STANDARD DEVIATION AND AVERAGE ELIGIBLE CASH EXPENSE PER ACRE FOR ALL FARMS AND THE SUBGROUPS – 1974, 1975 AND 1976 FOR SOUTHWEST MANITOBA AND SOUTHEAST SASKATCHEWAN

	1974		1975		1976	
	Std. Dev.	C.O.V.	Std. Dev.	C.O.V.	Std. Dev.	C.
Farm Group	(S)	(S/$\overline{X}$)	(S)	(S/$\overline{X}$)	(S)	(S/$\overline{X}$)
	$	%	$	%	$	%
Grain farms	9.37	52.7	9.49	43.3	9.52	38.1
Grain-livestock farms	10.45	51.1	11.75	50.3	11.41	44.0
Large farms	6.64	40.4	9.14	42.7	8.37	36.6
Small farms	11.83	54.5	11.12	46.9	11.65	41.0
High productivity	11.08	48.6	10.39	40.1	11.81	41.3
Low productivity	7.55	47.7	9.08	47.2	7.94	35.1
Large, high-productivity	7.19	35.5	10.34	39.0	9.45	35.7
Large, low-productivity	4.71	34.3	5.11	29.8	6.91	33.4
Small, high-productivity	12.33	50.1	10.55	41.4	13.46	43.7
Small, low-productivity	9.44	51.2	11.60	54.2	8.69	33.8
All farms	9.99	52.1	10.02	44.2	10.29	40.6

Results

Specific tests for normality of the cash expense frequency distributions were conducted at the 5-percent probability level. The tests indicated that all frequency distributions were normal except the 1974 small-farm distribution. The results were derived by using null hypothesis tests (parametric and non-parametric) of the equality of cash expense means and variances (Tables 7, 8 and 9).

There was consistently no significant difference in the cash expense means and variances of grain and grain-livestock farms. Grain farms were larger than grain-livestock farms in each of the three years and consequently had lower average expenses per acre. Tables 4, 5 and 6 show that as the size of the two groups approached equality the difference in cash expense per acre decreased.

In 1974 and 1976, there was a significant difference in the cash expense means and variances of large and small farms. In all years, large farms had lower cash expenses per acre than their small farm counterpart groups. In 1974, soil-productivity ratings were comparable for large and small farms and therefore the differences in cash expenses were attributed to economies of size. In 1975 and 1976, however, soil-productivity and size differences were considered to be contributing factors to lower cash expenses per acre on large farms.

In each of the three years there was a significant difference in the cash expense means of high and low soil-productivity farms. Also, in 1974 and 1976 their variances were significantly different. Smaller size and higher soil-productivity ratings were considered to be factors contributing to higher cash expense per acre on high-productivity farms.

Cash expense per acre was significantly higher on large, high soil-productivity farms than on large, low productivity farms in all years. Since the sizes of the counterpart groups were not significantly different (i.e., differing by less than 10 percent in acreage), most of the difference in cash expense per acre was attributed to variation in soil-productivity level.

In 1974 and 1976, cash expense per acre was significantly lower on large, low soil-productivity farms than on small, low soil-productivity farms. Since soil-productivity levels were comparable, the difference in cash expense per acre was attributed to size. (Tax assessments per acre for large low-productivity farms were $0.95 in 1974 and $1.59 in 1976. The assessments for small low-productivity farms were $0.85 in 1974 and $1.60 in 1976).

[5] Statistics Canada, Farm Input Price Index, 1976 and 1977. The itemized expenses for 1975 and 1976 were deflated to 1974 levels based on input price changes in Western Canada.

Because of the large number of farms having 10 to 30 percent livestock-productive work units, the farms were reclassified into specialized grain enterprise and grain-livestock farms. Specialized grain farms had less than 10-percent livestock PMWU and grain-livestock farms had more than 20-percent livestock PMWU. Soil-productivity ratings for specialized grain farms based on tax assessments per cultivated acre were $1.37 in 1974, $1.68 in 1975 and $2.48 in 1976. The ratings for grain-livestock farms were $1.28 in 1974, $1.68 in 1975 and $1.92 in 1976. Comparative sizes for specialized grain and grain-livestock farms were 782 and 682 acres in 1974, 895 and 698 acres in 1975 and 900 and 821 acres in 1976. In all years, the differences in cash expenses per crop acre were non-significant. In 1974 and 1975, however, specialized grain farms had lower expenses per acre due mainly to economies of size. In 1976, the lower expense due to size was offset by the higher expense due to the soil-productivity level. This resulted in a near identical cash expense per acre for the two groups.

Linear regressions of cash expenses on the four variables mentioned previously indicated that for high soil-productivity farms the functional relationship was only significant for the machinery capital variable. R^2 values of 18 percent, 11 percent and 22 percent for 1974, 1975 and 1976 indicated that the four variables accounted for only a small part of the total cash expense variation.

Linear regressions for low soil-productivity farms indicated that the functional relationship between cash expense and the three variables (number of improved acres, tax assessment and machinery capital) was statistically significant. However, the R^2 values of 47 percent for 1974, 16 percent for 1975 and 34 percent for 1976 indicated that the strength of the relationship between cash costs and the four variables changed considerably from year to year.

CONCLUSIONS

The large standard deviations, compared with the means, indicated that there was a fairly wide range in the eligible cash expenses per acre for the total farm sample and for most of the major groups. From this it was concluded that the farm sample to be used for WGSA purposes should be large enough so that at least two subgroups could be delineated for each of the major classes (type,

TABLE 4. 1974 CASH EXPENSES PER IMPROVED ACRE, 110 FARMS GROUPED BY TYPE, SIZE AND SOIL-PRODUCTIVITY LEVEL, SOUTHWEST MANITOBA AND SOUTHEAST SASKATCHEWAN

Item	Grain	Grain Livestock	Large	Small	High Productivity	Low Productivity	All Farms
Number of farms	52	58	53	57	53	57	110
Machinery capital per acre	40.39	47.65	40.27	47.88	48.85	39.91	44
Improved acres	906	682	1,106	492	705	865	788
Livestock PWU	54	137	115	81	90	104	97
Crop PWU	543	341	553	246	352	432	394
Ratio: crop PWU / total PWU	.89	.71	.83	.75	.80	.81	.80
			— Dollars per Improved Acre —				
Fertilizers	3.30	2.56	2.68	3.12	3.71	2.17	2.91
Spray material	1.16	.77	.95	.96	1.13	.79	.96
Fuel, oil and grease	2.37	2.83	2.23	2.97	2.95	2.30	2.62
Machinery repairs[a]	3.29	4.03	3.12	4.20	4.34	3.06	3.68
Crop insurance	.46	.49	.49	.47	.63	.34	.48
Crop supplies[b]	.84	.80	.59	1.03	1.02	.64	.82
Custom work	.75	1.26	.87	1.16	1.36	.70	1.02
Hired labor	.50	1.22	.97	.80	1.12	.67	.88
Building and fence repair	1.57	2.27	1.17	2.65	2.14	1.75	1.94
Car expenses	.70	.73	.60	.82	.76	.67	.71
Miscellaneous[c]	1.54	2.18	1.50	2.22	1.92	1.83	1.87
Land tax	1.30	1.28	1.26	1.32	1.70	.90	1.29
Total cash expenses	17.78	20.42	16.43	21.72	22.78	15.82	19.18

[a]Includes machinery repairs, license and insurance premiums.

[b]Includes seed purchases, seed cleaning and treatment.

[c]Includes tool purchases, equipment rent, utility expenses and other miscellaneous expenses.

TABLE 5. 1975 CASH EXPENSES PER IMPROVED ACRE, 117 FARMS GROUPED BY TYPE, SIZE AND SOIL-PRODUCTIVITY LEVEL, SOUTHWEST MANITOBA AND SOUTHEAST SASKATCHEWAN

Item	Grain	Grain-Livestock	Large	Small	High Productivity	Low Productivity	All Farms
Number of farms	56	61	53	64	60	57	117
Machinery capital per acre	55.67	61.16	55.83	61.19	63.54	53.42	58.65
Improved acres	917	698	1126	495	721	873	795
Livestock PWU	54	151	125	85	97	112	104
Crop PWU	455	352	573	247	352	455	401
Ratio: crop PWU / total PWU	.89	.70	.82	.74	.78	.80	.79
			– Dollars per Improved Acre –				
Fertilizers	4.51	3.13	3.74	3.83	4.34	3.22	3.79
Spray material	1.85	.93	1.30	1.43	1.65	1.08	1.37
Fuel, oil and grease	3.02	3.55	3.22	3.36	3.65	2.92	3.30
Machinery repairs[a]	3.49	3.77	3.52	3.73	4.10	3.15	3.64
Crop insurance	.61	.44	.55	.50	.66	.38	.52
Crop supplies[b]	1.31	1.12	1.04	1.35	1.57	.83	1.21
Custom work	.55	1.39	.82	1.12	1.14	.83	.99
Hired labor	.98	1.28	1.61	.74	1.40	.86	1.14
Building and fence repair	1.08	2.00	1.21	1.86	1.87	1.23	1.56
Car expenses	.81	.96	.68	1.06	.74	1.04	.89
Miscellaneous[c]	1.98	3.10	2.15	2.90	2.54	2.58	2.56
Land tax	1.73	1.68	1.56	1.82	2.25	1.12	1.70
Total cash expenses	21.92	23.35	21.40	23.70	25.91	19.24	22.67

[a]Include machinery repairs, license and insurance premiums.
[b]Includes seed purchases, seed cleaning and treatment.
[c]Includes tool purchases, equipment rent, utility expenses and other miscellaneous expenses.

size and soil productivity). Ideally, the sample should allow for further sorting within the classes. This would make it possible to more clearly identify the dominant classification criteria.

The results of the hypotheses tests indicated that in developing the CANFARM sample the main concern should be with adequate representation of farms according to size and soil-productivity level, because there was a significant difference in cash expenses per acre between large and small farms and between high soil-productivity and low soil-productivity farm groups. Cash expenses per acre did not differ significantly between grain and grain-livestock farms in any of the three years. Grain farms were on the average consistently larger than grain-livestock farms and consequently had slightly lower average expenses per acre. As differences in size and soil productivity decreased, cash expenses per acre on grain and grain-livestock farms tended to converge.

The conclusions of this study were based on the results obtained from one method of expense allocation which might not be the best. There is a difficulty in choosing the best allocation method, however, because the real cash expenses on grain-livestock farms per grain acre are unknown. Hence, any alternative allocation method will at best provide another estimate that might be more acceptable to the farmer from an accounting standpoint.

A comprehensive study of joint cash-expense methodology is required before a particular method or methods can be recommended. Farmer-allocated expense data should be obtained and compared with the results from alternative methods, including the one used in this study. If the results are comparable, the emphasis on proper representation of multi-enterprise farms in the sample and the best method of cash-expense allocation for Western Grain Stabilization purposes could be relaxed. However, the allocation method should remain consistent from year to year. Switching methods among years could distort the estimates of net cash flow.

Linear regressions of cash expenses per acre on the four variables (ratio of crop PMWUs to farm PMWUs, number of improved acres, tax assessment per improved acre and machinery capital per improved acre) indicated that for high-productivity farms only the machinery capital variable was significant. For low-productivity farms

TABLE 6. 1976 CASH EXPENSES PER IMPROVED ACRE, 87 FARMS GROUPED BY TYPE, SIZE AND SOIL-PRODUCTIVITY LEVEL, SOUTHWEST MANITOBA AND SOUTHEAST SASKATCHEWAN

Item	Grain	Grain-Livestock	Large	Small	High Productivity	Low Productivity	All Farms
Number of farms	51	36	48	39	40	47	87
Machinery capital per acre	64.11	53.01	56.91	68.03	65.12	56.03	59.82
Improved acres	919	821	1,178	510	796	948	878
Livestock PWU	46	182	124	74	77	124	102
Crop PWU	459	411	589	255	398	474	439
Ratio: crop PWU / total PWU	.91	.69	.83	.78	.84	.79	.81
			— Dollars per Improved Acre —				
Fertilizers	3.30	3.18	2.91	3.68	3.82	2.78	3.25
Spray material	2.12	1.02	1.30	2.12	2.27	1.15	1.67
Fuel, oil and grease	4.17	4.33	3.92	4.63	4.49	4.02	4.24
Machinery repairs[a]	3.47	4.12	3.40	4.15	3.78	3.70	3.74
Crop insurance	.90	.51	.74	.74	.86	.64	.74
Crop supplies[b]	1.70	1.51	1.57	1.68	1.80	1.47	1.62
Custom work	.77	.98	.87	.84	.91	.81	.86
Hired labor	1.17	1.60	1.30	1.40	1.57	1.15	1.34
Building and fence repair	1.64	2.06	1.48	2.22	1.87	1.76	1.81
Car expenses	.99	1.47	.82	1.65	1.19	1.19	1.19
Miscellaneous[c]	2.38	3.24	2.52	3.00	3.20	2.34	2.73
Land tax	2.34	1.92	2.05	2.31	2.84	1.59	2.16
Total cash expenses	24.96	25.94	22.88	28.42	28.60	22.61	25.36

[a]Includes machinery repairs, license and insurance premiums.
[b]Includes seed purchases, seed cleaning and treatment.
[c]Includes tool purchases, equipment rent, utility expenses and other miscellaneous expenses.

three of the variables (number of improved acres, tax assessment and machinery capital) had a significant influence on cash expenses per improved acre. However, the R^2 values of 47 percent for 1974, 16 percent for 1975 and 34 percent for 1976 indicated that the strength of the relationship varied considerably from year to year. This implied that these variables by themselves would not be reliable in estimating cash expenses.

TABLE 7. TESTS OF EQUALITY OF CASH EXPENSE MEANS AND VARIANCES, 1974 DATA

Farm Group	$\hat{t}$	$t^{cr}_{.025}$	$H_0: \bar{X}_1 = \bar{X}_2$	$\hat{F}$	$F^{cr}_{.025}$	$H_0: S^2_1 = S^2_2$
Grain: Grain-Livestock (52) (58)	−1.39	1.96	accept	1.24	1.68	accept
Large: Small (53) (57)	−2.86	1.96	reject	3.18	1.78	reject
High-Prod.: Low-Prod. (53) (57)	3.87	2.00	reject	2.16	1.80	reject
Large, High: Large, Low (22) (31)	5.04	2.00	reject	2.33	2.20	reject
Small, High: Small, Low (31) (26)	2.24	2.00	reject	1.70	2.19	accept
Large, High: Small, High (22) (31)	−1.59	2.01	accept	2.94	2.20	reject
Large, Low: Small, Low (31) (26)	−4.03	2.00	reject	4.03	2.13	reject

TABLE 8. TESTS OF EQUALITY OF CASH EXPENSE MEANS AND VARIANCES, 1975 DATA

Farm Group	$\hat{t}$	$t^{cr}_{.025}$	$H_0: \bar{X}_1 = \bar{X}_2$	$\hat{F}$	$F^{cr}_{.025}$	$H_0: S^2_1 = S^2_2$
Grain: Grain-Livestock (56) (60)	−0.72	1.98	accept	1.53	1.71	accept
Large: Small (55) (61)	−1.20	1.98	accept	1.48	1.70	accept
High-Prod.: Low-Prod. (60) (56)	3.68	1.96	reject	1.31	1.70	accept
Large, High: Large, Low (24) (31)	4.31	2.01	reject	4.09	2.21	reject
Small, High: Small, Low (36) (25)	1.47	2.00	accept	1.21	2.00	accept
Large, High: Small, High (24) (36)	0.38	2.00	accept	1.04	2.19	accept
Large, Low: Small, Low (31) (25)	−1.80	2.01	accept	5.15	2.16	reject

TABLE 9. TESTS OF EQUALITY OF CASH EXPENSE MEANS AND VARIANCES, 1976 DATA

Farm Groups	$\hat{t}$	$t^{cr}_{.025}$	$H_0: \bar{X}_1 = \bar{X}_2$	$\hat{F}$	$F^{cr}_{.025}$	$H_0: S^2_1 = S^2_2$
Grain: Grain-Livestock (51) (36)	−0.44	2.00	accept	1.53	1.85	accept
Large: Small (48) (39)	−2.58	2.00	reject	1.94	1.85	reject
High-Prod.: Low-Prod. (40) (47)	2.81	2.00	reject	2.21	1.85	reject
Large, High: Large, Low (19) (29)	2.33	2.01	reject	1.87	2.30	accept
Small, High: Small, Low (21) (18)	1.38	2.02	accept	2.40	2.70	accept
Large, High: Small, High (19) (21)	−1.23	2.02	accept	2.03	2.55	accept
Large, Low: Small, Low (20) (18)	−2.17	2.02	reject	1.58	2.54	accept

However, it is likely that additional quantitative and many qualitative factors influence cash expenses in varying degrees on differentiated farms in the same year and on the same farms in different years. A large amount of additional detailed data with the associated increase in data collection costs would be required to research and maintain reliable regression equations over time. The limited benefits gained by grain producers and more efficient administration of the WGSA would not justify this action.

It is recommended that subsequent CANFARM samples include an appropriate representation of multi-enterprise farms selected according to three size- and three soil-productivity levels. The regular CANFARM accounts should include itemized expenditures for the farm and for the grain enterprise. Supporting supplementary questionnaires to be completed at the end of the accounting year should include detailed accountings of the beginning- and ending-year livestock numbers; land acres, use and assessments; labor source and use and a schedule of questions designed to clarify and categorize the methods used by farmers in each expense allocation. The supplementary questionnaire could be adapted as required by the information needs and time constraints. It could be completed by the CANFARM technician at the end of the accounting year at a time convenient to the farmer and thus need not interfere with the regular CANFARM accounting procedure.

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EVENTS

Food Strategy

In early December 1977, nine national food, agriculture and consumer organizations presented their views on agriculture and food to a panel of federal cabinet ministers chaired by Agriculture Minister Eugene Whelan. The organizations represented were:

- the Canadian Federation of Agriculture,
- the Meat Packers Council of Canada,
- the Canadian Food Processors Association,
- the Consumers Association of Canada,
- the Fisheries Council of Canada,
- the Canadian Restaurant and Food Services Association,
- the Retail Council of Canada,
- the National Dairy Council and
- the Grocery Products Manufacturers of Canada.

On January 16, 1978, a meeting of federal and provincial ministers was held in Winnipeg as a second step in the development of a Canadian food strategy. In addition to Agriculture Canada, the following federal departments particpated: Consumer and Corporate Affairs; Health and Welfare; Industry, Trade and Commerce; Regional Economic Expansion and Fisheries and Environment. The participants exchanged ideas on issues and problems between provincial and federal departments associated with the Canadian food industry. They also discussed the federal government's white paper "A Food Strategy for Canada" and the federal departments reported progress on issues related to agricultural development, food processing, distribution, retailing and consumer concerns.

A national food strategy conference attended by representatives and observers of the Canadian food industry was held in Ottawa on February 22 and 23, 1978. The participants concentrated on developing policies for food production, processing and distribution; consumer interests and initiatives for improving the food system.

International Conference of Agricultural Economists

The seventeenth International Conference of Agricultural Economists will be held September 3-12, 1979, at Banff, Alberta.

"Rural Change – The Challenge to Agricultural Economists" will be the primary theme of this conference. Other topics will be "Fifty Years–Vision, Accomplishments and Future" and "The Challenge of the Multidisciplinary Approach".

Glen Johnson, Michigan State University, East Lansing, Michigan, is in charge of the program while Walt Anderson, Agriculture Canada, Ottawa, is developing part of the program on Canadian Agriculture in cooperation with departments of agricultural economics at various Canadian universities.

All correspondence and enquiries should be addressed to: IAAE, Rural Economy, University of Alberta, Edmonton, Alberta, Canada, T6G 2H1.

IN REPLY

Note to Readers: We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we'll try to accommodate you.

When forwarding your 'In Reply' or letter, indicate if we may publish your comments in a subsequent issue.

D. Warnock, an agronomist from Melfort, Saskatchewan, says that the article by Wayne D. Jones and Fu-Lai Tung, "Regional Comparison of Structural Change and Resource Use in the Canadian Farm Industry, 1961 to 1971", in our October issue was particularly useful since all comparisons were made in constant dollars. He feels that the article will "be even more pertinent when 1976 data are available, particularly in view of the changes in costs, etc., in this later period without similar changes in price received. Increased efficiency cannot forever fill the gap."

R.N. Plank, Assistant Regional Manager of the Farm Credit Corporation in British Columbia, also found the Jones-Tung article useful and is looking forward to a continuation of the analysis using 1976 data. "We have tried to do something similar on a limited scale – because inflation does distort census figures. My preference for economics classes would be:

Less than \$ 5,000
\$ 5,000 – 9,999
10,000 – 14,999
15,000 – 19,999
20,000 +

We are interested in commercial farms."

IN REPLY TO AUTHORS AND EDITORS REGARDING FEBRUARY 1978 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) Farm Debt in Canada
(2) Business Organization and Growth Patterns of Farms in Saskatchewan
(3) Variation in Cash Expenses on Western Grain Farms

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

   not useful 1 2 3 4 5 6 7 8 9 10 very useful

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr. or Ms.) ______________________ Occupation ______________
(Please Print)

ADDRESS ____

Please return the above to:

John McConnell, Managing Editor, Canadian Farm Economics
Information Division
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:
LINEAR		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
AREA		
square inch	x 6.5	square centimetre (cm^2)
square foot	x 0.09	square metre (m^2)
acre	x 0.40	hectare (ha)
VOLUME		
cubic inch	x 16	cubic centimetre (cm^3)
cubic foot	x 28	cubic decimetre (dm^3)
cubic yard	x 0.8	cubic metre (m^3)
fluid ounce	x 28	millilitre (ml)
pint	x 0.57	litre (ℓ)
quart	x 1.1	litre (ℓ)
gallon	x 4.5	litre (ℓ)
WEIGHT		
ounce	x 28	gram (g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (t)
TEMPERATURE		
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius (°C)
PRESSURE		
pounds per square inch	x 6.9	kilopascal (kPa)
POWER		
horsepower	x 746	watt (W)
	x 0.75	kilowatt (kW)
SPEED		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
AGRICULTURE		
gallons per acre	x 11.23	litres per hectare (ℓ/ha)
quarts per acre	x 2.8	litres per hectare (ℓ/ha)
pints per acre	x 1.4	litres per hectare (ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare (ml/ha)
tons per acre	x 2.24	tonnes per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

CANADA DEPARTMENT OF AGRICULTURE
OTTAWA, ONT.
K1A 0C5

VOLUME 13 NUMBER 2 APRIL 1978

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. EUGENE WHELAN, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

CANADIAN FARM ECONOMICS (CFE) is published bi-monthly by the Information Division, Canada Department of Agriculture, Sir John Carling Building, Ottawa, and is based on material prepared by members of the Economics Branch.

Purpose: To provide current information on agricultural economics to agricultural economists, decision makers, researchers, extension workers, farm mass media serving farmers and the agricultural food industry, leading farmers, farm organizations, agri-business groups, librarians and offices abroad. CFE should be understandable to the majority of those on the mailing list.

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STRUCTURAL CHANGES AND PRODUCTION TRENDS IN THE POTATO INDUSTRY OF THE MARITIME PROVINCES

Producers in the Maritime Provinces have been adjusting their production and marketing to remain competitive. In Prince Edward Island and New Brunswick, there are fewer producers but larger production units situated on more suitable land.

Producers are considering collective action so that marketing, packaging, markets information and quality control can be dealt with on an industry-wide basis.

*W.L. Hanlon**

INTRODUCTION

Potatoes are produced in most regions of Canada but commercial production is more pronounced in Prince Edward Island, New Brunswick, Manitoba and Alberta. Data based on the 1976 Census of Agriculture (Table 1) indicate that potato acreage per farm reporting is highest in those provinces.

The Maritime Provinces currently account for 42 percent of Canadian potato acreage. In this region commercial potato production is located almost entirely in Prince Edward Island and New Brunswick, and between 1957 and 1976, potatoes have become increasingly important to the agricultural economies of these provinces. Receipts from potatoes are now averaging 41 percent of farm cash receipts in Prince Edward Island and 37 percent in New Brunswick compared with 33 and 23 percent for the 1957-61 period (Table 2).

Potato acreage has increased only slightly in Prince Edward Island and New Brunswick in recent years but growers have made important changes at the farm level to remain competitive with other producing regions in North America and Europe. This article discusses some of these major trends and attempts to show their relationship to the potato industry of the two provinces.

STRUCTURE

The number of farms growing potatoes has decreased considerably while the average size of potato enterprise on each farm has increased dramatically (Table 3). In 1961, 13,902 producers in the two provinces were growing approximately 100,000 acres of potatoes. By 1976, the number of producers had fallen to 2,094 while the acreage had increased to about 107,000. In 1976, 1,249 farms accounted for more than 90 percent of the potato acreage in the two provinces.

Such production concentration on a relatively small group of farms could facilitate group action on many important issues facing the industry. In New Brunswick, producers are trying to organize an association to speak for growers on many important issues relating to production and marketing. P.E.I. potato producers already have a similar organization which deals with production aspects of the industry. This organization has representatives on the P.E.I. Potato Marketing Board.

*W.L. Hanlon is an economist with the Atlantic Provinces' Regional Office, Policy and Economics Branch, Agriculture Canada, Truro, Nova Scotia.

TABLE 1. POTATOES ON CENSUS FARMS, 1976

Province	Acres	Percent	Farms Reporting	Acres per Farm
Newfoundland	985	0.4	181	5.4
Prince Edward Island	51,443	19.6	1,048	49.1
Nova Scotia	3,606	1.4	275	13.1
New Brunswick	55,125	21.1	892	61.8
Maritimes	110,174	42.1	2,215	
Quebec	42,034	16.0	2,818	14.9
Ontario	45,227	17.3	1,666	27.1
Central	87,261	33.3	4,484	
Manitoba	34,527	13.2	247	139.8
Saskatchewan	1,932	0.7	82	23.6
Alberta	16,151	6.2	243	66.5
Prairies	52,610	20.1	572	
British Columbia	10,653	4.1	390	27.3
Yukon & N.W.T.	50	–	5	–
Canada	261,733	100.0	7,847	33.4

Source: Census of Canada, Agriculture, 1976.

MACHINERY AND LABOR USE

The most important factor responsible for the increased size of the potato enterprise has been the mechanization of harvesting through the use of two-row potato harvesters and bulk bins for hauling to storage. In one day a harvesting crew of seven can harvest and store about seven to ten acres of potatoes.

Before mechanization potatoes were usually picked up by hand and placed in bags, barrels or boxes, loaded on flatbed trucks and hauled to storage. About 25 people would be required to harvest and store approximately seven acres a day. In addition, the farm operator had to ensure that workers would be available for each day of harvesting.

Mechanized harvesting increased the productivity of harvest workers about three to four times. Although per-unit costs of producing potatoes did not necessarily decrease with the introduction of harvesters (Retson and Hanlon), a much larger potato acreage is now possible for each farm without the responsibility and difficulty of managing large numbers of harvest workers.

Other developments are also tending to reduce labor input and increase productivity. One is the use of larger field equipment which reduces the man-hours per acre for pre-harvest operations. With the development of improved grass and weed sprays, growers now cultivate only two or three times to control weeds, whereas growers previously cultivated up to five or six times during the growing season. Also, new four-row and even eight-row harvesters will reduce harvest labor.

Two developments have tended to reduce labor requirements for the farm sector and increase them for the non-farm sector. Potato growers are using aerial spraying on a custom basis more widely and an increasing proportion of potatoes are being shipped to processors, reducing farm labor for grading and packaging.

TABLE 2. FARM CASH RECEIPTS, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1957-61 AND 1972-76

Commodity	Prince Edward Island				New Brunswick			
	Annual Average 1957-61		Annual Average 1972-76		Annual Average 1957-61		Annual Average 1972-76	
	mil. $	%	mil. $	%	mil. $	%	mil. $	%
Potatoes	8.6	33.2	31.7	40.6	9.7	23.3	35.4	37.1
Other crops	1.2	4.6	8.2	10.4	3.0	7.2	8.3	8.6
Livestock and products	15.8	60.7	33.9	43.4	26.2	62.9	46.4	48.5
Other receipts	0.4	1.5	4.4	5.6	2.8	6.6	5.5	5.8
Total farm receipts	26.0	100.0	78.2	100.0	41.7	100.0	95.6	100.0

Source: Statistics Canada, *Farm Cash Receipts,* Catalogue No. 21-201, Annual, Ottawa.

TABLE 3. STRUCTURE OF POTATO ENTERPRISE BY ECONOMIC CLASS OF FARM, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1961 AND 1976

Value of Agricultural Products Sold	1961 No. of Farms Reporting Potatoes	1961 Acres of Potatoes	1961 Percent of Potato Total	1961 Acres per Farm Reporting	1976 No. of Farms Reporting Potatoes	1976 Acres of Potatoes	1976 Percent of Potato Total	1976 Acres per Farm Reporting
Prince Edward Island								
$10,000 and over	251	9,070	20	36	680	47,313	92	70
$ 5,000 – 9,999	797	10,876	23	14	177	2,079	4	12
$ 2,500 – 4,999	1,478	12,379	27	8	105	1,387	3	13
$ 1,200 – 2,499	1,358	7,815	17	6	86	660	1	8
$ 1,200 and over	3,884	40,140	87	10	1,048[b]	51,443	100	49
$ 50 – 1,199	1,828	6,033	13	3	49[c]	177	–	4
Province	5,712[a]	46,173	100	8	1,097	51,620	100	47
New Brunswick								
$10,000 and over	425	24,558	45	58	569	51,444	93	90
$ 5,000 – 9,999	773	11,819	22	15	113	2,094	4	19
$ 2,500 – 4,999	1,118	7,834	14	7	113	1,007	2	9
$ 1,200 – 2,499	1,529	3,979	7	3	97	585	1	6
$ 1,200 and over	3,845	48,190	89	13	892[b]	55,125	100	62
$ 50 – 1,199	4,345	5,975	11	1	105[c]	392	–	4
Province	8,190[a]	54,165	100	7	997	55,517	100	56

[a]Census Farms, 1961.
[b]Census Farms, 1976.
[c]Other agricultural holdings, 1976.

Source: Census of Canada, Agriculture, 1961 and 1976.

Members of the Policy and Economics Branch of Agriculture Canada have done several economic studies related to potato production in the Maritime Provinces over the past 25 years, giving some indication of the relative changes in labor and machinery input in potato production (Table 4). These studies showed that the average cost of total labor input decreased from 33 to 23 percent of total costs by adopting labor-saving methods,

TABLE 4. LABOR AND MACHINERY COSTS AS A PERCENT OF TOTAL COSTS, BY HARVEST METHOD, POTATO ENTERPRISE STUDIES, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1950-76

Crop Year	Province	No. of Farms	Potato Acreage	Total Cost per Acre ($)	Hand-picking Harvest Labor	Hand-picking Harvest Machinery	Mechanized Harvest Labor	Mechanized Harvest Machinery
					– percent of total potato costs –			
1950	P.E.I.	80[a]	8.1	145	40	18	–	–
1959	N.B.	31[b]	38.2	233	28	18	–	–
1969	N.B.	16[c]	166.0	332	31	19	–	–
1969	N.B.	25[c]	182.2	326	–	–	25	25
1975	N.B.	6[d]	159.7	695	–	–	26	31
1976	N.B.	6[d]	177.7	784	–	–	22	29
1976	P.E.I.	5[d]	107.0	773	–	–	17	32
Average per study					33	18	23	29

[a]Retson, G.C. and E.S. Eaton, *Potato Production in Prince Edward Island*, unpublished report, Policy and Economics Branch, Agriculture Canada, Truro, N.S., 1950.
[b]Retson, G.C., "Cost of Producing Potatoes on Selected New Brunswick Farms," *Economic Analyst*, 23 (February 1972).
[c]Retson, G.C. and W.L. Hanlon, "Potato Production Costs and Practices in New Brunswick," *Canadian Farm Economics*, 5 (February 1973).
[d]Agriculture Canada, Policy and Economics Branch, *Potato Enterprise Case Studies, New Brunswick and Prince Edward Island*, unpublished yearly reports, Truro, N.S.

and that the relative cost of machinery input increased from 18 to 29 percent of total costs.

Labor input decreased relatively more than indicated by the percentage of total costs. From 1950 to 1976, the index of farm input costs shows that labor rates increased about 245 percent while machinery costs increased only 158 percent.

LAND USE

During the past 15 years, there have been changes in the use of land for potato production in both provinces. While they have generally experienced a decrease in land used for crops, potato acreage has increased and become more concentrated in commercial growing areas (Table 5).

In Prince Edward Island, total crop acreage has decreased but potato acreage has increased, indicating that potatoes have been more profitable than many other crops. Within the province, potato acreage has increased in Prince County and decreased in the other two. Soil conditions and topography in Prince County, particularly just east of Summerside, are considered more suitable for potatoes than many other areas of the province.

A similar concentration of potato production exists in New Brunswick. Victoria, Carleton and Madawaska Counties have traditionally accounted for a large portion of the potato acreage (84 percent in 1961). While production has decreased in the non-commercial areas of the province, acreage planted has increased in these counties. In 1976, they accounted for 96 percent of the province's potato acreage. In fact more than half of the crop acres in Victoria County and slightly more than a quarter in Carleton County are now used for potato production.

Land Rotation

Rotation practices of commercial potato farmers in Prince Edward Island are different from those of growers in New Brunswick. P.E.I. growers and potato specialists maintain that a three-year rotation should be followed to keep the moisture-holding capacity and soil structure at standards necessary for the best potato production. This is particularly important when growing Netted Gems since dry spells during the growing season can adversely affect their quality. Soil-borne diseases are also easier to control with longer rotation.

Two recent studies indicate the type of land use practised by selected potato growers in the two provinces (Table 6). The sample group of P.E.I. growers is following a three-year rotation, and to secure an adequate land base for rotation they were renting approximately a third (105 acres) of the cropland used in their operations. While the sample is small, it does indicate the importance that P.E.I. growers attach to rotating potatoes.

TABLE 5. LOCATION OF COMMERCIAL POTATO PRODUCTION BY COUNTY, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1961 AND 1976

County	1961 Potatoes	1961 Total Crops	1976 Potatoes	1976 Total Crops
	— acres —			
Prince Edward Island				
Prince County	23,651	153,701	32,641	148,073
Queens County	13,912	165,442	10,721	157,845
Kings County	8,610	71,969	8,081	69,290
Province	46,173	391,112	51,443	375,208
New Brunswick				
Victoria County	20,601	41,222	22,324	38,354
Carleton County	16,577	96,876	22,016	85,556
Madawaska County	8,196	46,805	8,767	28,547
Other counties	8,791	297,645	2,018	160,345
Province	54,165	482,548	55,125	312,702

Source: Census of Canada, Agriculture, 1961 and 1976.

TABLE 6. LAND USE ON SELECTED COMMERCIAL POTATO FARMS IN PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1969 AND 1976

Variety	5 P.E.I. Farms 1976[a]	41 N.B. Farms 1969[b]	7 N.B. Farms 1976[a]
		— acres —	
Netted Gem	25	67	82
Kennebec	63	70	66
Sebago	15	—	—
Katahdin	—	25	4
Other varieties	4	14	14
Total	107	176	166
Other cropland suitable for potatoes	210	115	94
Total cropland	317	291	260

[a]Agriculture Canada, Policy and Economics Branch, *Potato Enterprise Case Studies,* unpublished yearly reports, Truro, N.S.

[b]Retson, G.C. and W.L. Hanlon, "Potato Production Costs and Practices in New Brunswick," Canadian Farm Economics, 8 (February 1973).

Commercial growers in New Brunswick do not usually rotate potato fields as often as their P.E.I. counterparts. Soils in the potato-growing region of the upper St. John Valley are apparently suited to planting potatoes almost every year.

Some growers said that they have been growing potatoes in certain fields for 20 years without detriment to yields or quality. In the N.B. sample (Table 6), the cropland base indicates that something shorter than a two-year potato rotation is followed.

The main crops rotated with potatoes in both provinces are grain and hay, which are selected for their compatibility with potatoes rather than their competitiveness. Without an alternative cash crop to compete with potatoes, growers will likely continue to practise as short a rotation as possible.

VARIETIES

Improved varieties and increased emphasis on sales to processors in recent years have caused important changes in potato varieties grown on commercial farms in Prince Edward Island and New Brunswick. Data on varieties are available on a provincial basis only for 1977, but before that time studies by the Policy and Economics Branch give some indication of the importance of varieties grown on commercial potato farms (Table 7). Between 70 and 80 percent of commercial production in each of the two provinces presently consists of Netted Gem (Russet Burbank in the United States) and Kennebec.

Since the Netted Gem is used for tablestock and seed and is preferred as a processing variety it can be classified as multipurpose. Kennebecs are in demand for tablestock, seed and to a limited extent by processors. Before the popularity of these varieties, most of the commercial acreage in Prince Edward Island consisted of Irish Cobbler, Green Mountain, Katahdin and Sebago. Of these, only Sebago is still important commercially. In New Brunswick, Katahdin had been by far the most popular variety in the 1950s but by 1969 it had become of minor importance and by 1977 accounted for only 4 percent of the commercial potato acreage. Newer varieties are continually being developed and tested but none has yet become commercially important in either province.

YIELDS

Over the past 20 years, the average potato yield per acre in the two provinces has shown an upward trend (Table 8). The increase in yield per acre has contributed

TABLE 7. TRENDS IN POTATO VARIETIES, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1945-77

	Prince Edward Island				New Brunswick			
Variety	80 Farms 1945[a]	80 Farms 1950[b]	5 Farms 1976[e]	Province 1977[f]	31 Farms 1959[c]	41 Farms 1969[d]	7 Farms 1976[e]	Province 1977[f]
				— percent —				
Netted Gem	–	–	23	36	–	38	49	50
Kennebec	–	–	59	37	13	40	40	28
Sebago	–	30[g]	14	14	6	–	–	–
Katahdin	–		–	–	52	14	2	4
Irish Cobbler	55	50[h]	–	–	–	–	–	–
Green Mountain	33		–	–	–	–	–	–
Other[i]	12	20	4	13	29	8	9	18
Total	100	100	100	100	100	100	100	100

[a]Agriculture Canada, Policy and Economics Branch, unpublished study, Truro, N.S., 1945.

[b]Retson, G.C. and E.S. Eaton, *Potato Production in Prince Edward Island,* unpublished report, Policy and Economics Branch, Agriculture Canada, Truro, N.S., 1950.

[c]Retson, G.C., "Cost of Producing Potatoes on Selected New Brunswick Farms," *Economic Analyst*, 23 (February 1972).

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[e]Agriculture Canada, Policy and Economics Branch, *Potato Enterprise Case Studies, Prince Edward Island and New Brunswick,* unpublished yearly reports, Truro, N.S.

[f]Statistics Canada, Agriculture Division, unpublished yearly reports, Truro, N.S.

[g]Approximate average of Sebago and Katahdin.

[h]Average of Irish Cobbler and Green Mountain.

[i]Includes varieties having no percentage entered.

TABLE 8. TRENDS IN POTATO DISPOSITION, PRINCE EDWARD ISLAND AND NEW BRUNSWICK, 1956-75

Period	Acres per Year	Yield per Acre	Total Production per Year	Disposition of Potato Crop: Tablestock	Seed	Total Shipments	Local Use, Seed and Processing	Cullage and Loss
		cwt		— 000 cwt (% in brackets) —				
Prince Edward Island								
1971 - 75	45,160	218	9,861	4,891	1,220	6,111	2,243	1,507
			(100.0)	(49.6)	(12.4)	(62.0)	(22.7)	(15.3)
1956 - 60	44,440	170	7,554	4,325	1,315	5,640	695	1,219
			(100.0)	(57.3)	(17.4)	(74.7)	(9.2)	(16.1)
New Brunswick								
1971 - 75	55,480	219	12,191	2,901	1,448	4,349	6,407	1,435
			(100.0)	(23.8)	(11.9)	(35.7)	(52.5)	(11.8)
1956 - 60	46,620	183	8,540	n.a.[a]	n.a.	5,561	1,520	1,459
			(100.0)	n.a.	n.a.	(65.1)	(17.8)	(17.1)

[a]Not available.

Source: Agricultural Statistics, Provinces of Prince Edward Island and New Brunswick.

significantly to total production. In Prince Edward Island, potato acreage is now approximately 1.6 percent (720 acres) more than in the 1956-60 period but production is 30.5 percent (2,307,000 cwt) higher. Similarly, in New Brunswick, acreage is averaging 19.0 percent (8,860 acres) higher than the 1956-60 period but current production is 42.7 percent (3,651,000 cwt) higher.

It is difficult to pinpoint specific reasons for the increase in yield per acre. One might be that a higher portion of the potato crop is now produced on larger commercial farms where commercial fertilizer is used at or in excess of recommended rates of application. In addition, potato production is becoming concentrated in the more favorable growing areas.

DISPOSITION AND MARKETING

There has also been a change over the past 20 years in the disposition of the potato crop in Prince Edward Island and New Brunswick (Table 8). Processors are using more of the crop and a smaller proportion is being shipped out of the provinces to tablestock and seed markets.

In Prince Edward Island, however, the volume shipped as tablestock has actually increased even though the proportion of the crop shipped through this outlet has slightly decreased. Tablestock markets are still the most important outlet for P.E.I. potatoes and account for approximately 50 percent of the total crop. The processing market has been expanding and the "local use, seed and processing" category now uses about 23 percent of the crop compared with only 9 percent in the 1956-60 period. Expanding processing facilities in the province could soon enable processors to handle up to a third of the crop if current sales prospects are maintained.

The trend towards increased sales for processing is more pronounced in New Brunswick where, despite an increase in total production, shipments for tablestock and seed have decreased. Separate data for tablestock and seed shipments are available only from 1962. Since then, shipments of tablestock potatoes have decreased while shipments of seed potatoes have remained relatively constant.

Farmers interviewed for N.B. potato-enterprise studies (Table 4) indicated that they had experienced many difficulties and uncertainties when shipping tablestock potatoes to central Canadian and export markets. These problems included the necessity of sometimes having to pay at destination points for regrading carloads of potatoes found to be below Canada No. 1 standards, inability to collect or delays in collecting from buyers at destination points, lower market prices at Montreal and Toronto for N.B. than for P.E.I. potatoes, lack of proper warehousing facilities for export potatoes at Saint John, and extreme fluctuations in market prices from year to year. Having found the processing market more stable, many growers have shipped an increasing portion of the potato crop through this outlet.

The major processor recently noted that potato production in its N.B. plants would probably remain stable when their new processing facilities become operational in Manitoba this year. Implications for N.B. growers are that they will have to pay more attention to tablestock and seed markets in the future if total production is to be maintained or expanded.

To further develop and service Canadian and export markets with tablestock and seed, collective action by growers might be necessary. Such marketing aspects as advertising, market information, packaging, quality control, varietal preference, etc., could be better approached on an industry basis. There is presently no one organization representing the N.B. potato growers on these matters but growers are making attempts to organize on a provincial basis.

SUMMARY

In an attempt to remain competitive on Canadian and export markets, potato producers in the Maritime Provinces have been adjusting to changing production and marketing conditions by adopting new production methods. In the two major producing provinces, Prince Edward Island and New Brunswick, there are fewer growers but with more potato acreage increasingly on soils most suited to potato production.

In recent years, shipments of P.E.I. tablestock potatoes have been increasing but in New Brunswick, growers have reduced shipments. In response to processor demand, growers in both provinces, particularly in New Brunswick, have been marketing an increasing proportion of their crops through processing outlets.

There is an indication that potato processing will expand in Prince Edward Island but probably not in New Brunswick. Growers in New Brunswick will probably need to pay more attention to developing more tablestock and seed markets. They are already organizing themselves, and if successful, the organization will be able to represent growers' interests on production and marketing aspects of the industry.

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THE USE OF AIRCRAFT IN AGRICULTURE

G.J. King*

Rural aircraft use has risen dramatically in recent years and its popularity continues to grow. Increasing numbers of commercial and private operators are discovering not only the small airplane's economic efficiency in weed and insect control, seeding and fertilizing but also other new uses. The author predicts a future when the private airplane will become a usual piece of farm machinery.

INTRODUCTION

The use of aircraft in Canadian agriculture has become increasingly important during the past two decades. Agriculture Canada conducted the first survey of aircraft use in Canadian agriculture in 1957. Subsequent surveys, for 1961, 1965 and 1971, have indicated a slow but steady increase in flying related to farming. Agricultural acreage sprayed increased from about 435,000 acres in 1957 to approximately 1,000,000 acres in 1971. Spraying refers to aerial applications of chemicals (for controlling weeds, disease, insects and brush) and distribution of fertilizers and seeds.

Recently Agriculture Canada carried out another survey of rural aircraft use for 1976 (King), the results of which show a dramatic increase in agricultural flying with over 2,500,000 acres reported as being aerially sprayed. The purpose of this study was to obtain primary data on aircraft use, namely quantitative and appraisal measures and information about developments since the last assessment (Philpotts 1972) as well as those that are currently taking place. The study provided information on agricultural spraying, agricultural non-spray aerial activities and non-agricultural activities. Specific items of interest included acreage covered, flying time, flying costs, chemicals applied and aircraft types. Comments pertinent to agricultural aviation were also solicited from respondents.

Questionnaires were mailed to 1,190 potential rural aircraft operators in three categories: 1. commercial operators – licensed for commercial aerial spraying (class 7AAD licence); 2. exemption operators – officially exempt from the above licensing regulations and carrying out spray operations within a 25-mile radius of their home bases; and 3. flying farmers – operating privately-registered aircraft for non-spray activity or for spraying over only their own farms.

About 61 percent of the operators returned questionnaires, with a similar response rate from all operator groups. Data were assembled according to two major regional groupings – the Prairies (Alberta, Saskatchewan and Manitoba) and the East (Quebec, Ontario and the Atlantic Provinces) and British Columbia. Agricultural activities recognized were weed and plant disease control, insect control, fertilization, seeding, brush control and defoliation and other agricultural flying.

The data presented below are generally adjusted from the figures reported by the 61 percent of respondents. Estimations based on the total population were made only for acres flown over.

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OPERATORS

Potential operators were located with the aid of the Canadian Transport Commission. The numbers of operation bases suggested far greater potential activity in the Prairies (917 operators) than in the East and British Columbia (273 operators). Returns indicated that 60 percent of the respondents in the Prairies were engaged in agricultural flying compared with 34 percent in the East and British Columbia (Table 1).

Of the respondents engaged in agricultural flying, approximately 50 percent in the Prairies and 33 percent in the East and British Columbia reported agricultural spraying. About half of the operators spraying in the Prairies were commercial or exemption operators, the other half flying farmers. In the East and British Columbia, spraying was almost exclusively carried out by commercial operators.

Approximately 73 percent of the respondents reporting agricultural flying in both regions, mainly exemption and flying farmer operators, engaged in other agricultural flying. This included flying to observe land, buildings, crops, pastures and livestock, to transport workers and supplies, to purchase and repair equipment and to attend agricultural meetings.

AGRICULTURAL SPRAYING

Acreage Sprayed

The operators sprayed 2,653,581 acres (adjusted total) for agricultural purposes in 1976 (Table 2). Sixty-five percent of this acreage was sprayed for weed and plant disease control, 15.0 percent for insect control, 3.5 for fertilizing, 3.5 for brush control and 0.7 for seeding. The rest of the reports did not give the purpose for spraying.

Approximately 80 percent of the aerially sprayed acres were in the Prairies and 20 percent in the East and British Columbia.

In the Prairies, weed and plant disease control was the dominant activity, accounting for about 72 percent of the acres sprayed. Most of this activity was for weed control, the greatest problem being wild oats, followed by wild mustard, various thistles, buckwheat, stinkweed, cowcockle, ragweed, pigweed and other less important weeds. Insect control was the next most important, with 8.5 percent of the acres sprayed mainly for grasshoppers, flea beetles, aphids and tent caterpillars.

In the East and British Columbia, weed and plant disease control and insect control were about equally important, both accounting for approximately 40 percent of the land aerially sprayed. Blight in beans and potatoes stood out as an important target disease and insects sprayed for included aphids and various beetles and worms (hornworms, armyworms and cutworms).

Fertilizing accounted for a further 14.5 percent of acreage sprayed. Respondents applied almost exclusively fertilizers supplying nitrogen, mostly to grain crops, hay and pasture.

Neither seeding nor brush control and defoliation were significant in either region; most of the acreage covered was in the Prairies. Grasses and rapeseed were the crops most often aerially seeded, followed by grain. Respondents reported brush control in pastures, rangeland and ditch banks, mainly in the Prairies, and some bean, potato, clover and rapeseed defoliation, largely in the East and British Columbia.

The Prairies dominated in weed and plant disease control (87 percent of the acreage sprayed for this activity), seeding (78 percent) and brush control (77 percent); the East and British Columbia led in insect control (58 percent) and fertilizing (85 percent). Commercial operators were responsible for spraying 61 percent of this acreage, exemption operators 23 percent and flying farmers 16 percent.

Flying time

This spraying involved a reported 20,000 hours of flying, about 72 percent of which were flown in the Prairies and 28 percent in the East and British Columbia. The East and British Columbia had a higher percentage of hours flown than of acres covered, whereas in the Prairies the percentages were reversed. This probably reflects the difference in agricultural environment, with more time required to complete similar operations in the East and British Columbia,[1] and differences in the activities performed. The speeds of operation, where possible to determine for the various activities and operator groups, were by no means uniform or consistent (Table 3). Within each operator group and region, however, operation speeds for weed and plant disease control and insect control were generally similar. Speeds of

[1] Philpotts (1971) showed that it took about twice as long to spray a field half a mile long, than a field with the same area and one mile long, due to increased turn time. For instance, a 100-acre field half a mile long required 31.94 minutes compared with 16.13 minutes for a 100-acre field, one mile long.

TABLE 1. TOTAL NUMBER OF QUESTIONNAIRES MAILED, AND DISTRIBUTION OF RETURNS, ACCORDING TO REGIONAL AGGREGATIONS AND OPERATOR GROUP

Status of Questionnaire	PRAIRIES								EAST AND BRITISH COLUMBIA								Canada	
	Commercial		Exemption		Flying Farmer		Total Prairies		Commercial		Exemption		Flying Farmer		Total East & B.C.			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total questionnaires mailed	66	100.0	69	100.0	782	100.0	917	100.0	52	100.0	2	100.0	219	100.0	273	100.0	1190	100.0
Total returned	43	65.2	50	72.5	438	56.0	531	57.9	40	76.9	1	50.0	145	66.2	186	68.1	717	60.3
Total returns	43	100.0	50	100.0	438	100.0	531	100.0	40	100.0	1	100.0	145	100.0	186	100.0	717	100.0
No activity indicated of types designated	6	14.0	2	4.0	103	23.5	111	20.9	9	22.5	—	—	38	26.2	47	25.3	158	22.0
Indicated only non-agricultural activity	5	11.6	—	—	98	22.4	103	19.4	10	25.0	—	—	66	45.5	76	40.9	179	25.0
Indicated agricultural activity	32	74.4	48	96.0	237	54.1	317	59.7	21	52.5	1	100.0	41	28.3	63	33.9	380	53.0
Total reporting agricultural activity	32	100.0	48	100.0	237	100.0	317	100.0	21	100.0	1	100.0	41	100.0	63	100.0	380	100.0
Indicated spray activity	32	100.0	46	95.8	80	33.8	158	49.8	18	85.7	1	100.0	2	4.9	21	33.3	179	47.1
Indicated other agricultural activity	3	9.4	28	58.3	201	84.8	232	73.2	5	23.8	1	100.0	40	97.6	46	73.0	278	73.2
Indicated non-agricultural activity	8	25.0	19	39.6	123	51.9	150	47.3	12	57.1	—	—	30	73.2	42	66.7	192	50.5
Total reporting spray activity	32	100.0	46	100.0	80	100.0	158	100.0	18	100.0	1	100.0	2	100.0	21	100.0	179	100.0
Weed and disease control	32	100.0	46	100.0	79	98.8	157	99.4	16	88.9	—	—	1	50.0	17	81.0	174	97.2
Insect control	23	71.9	28	60.9	35	43.8	86	54.4	13	72.2	1	100.0	1	50.0	15	71.4	101	56.4
Fertilizing	10	31.3	9	19.6	6	7.5	25	15.8	12	66.7		—	2	100.0	14	66.7	39	21.8
Seeding	13	40.6	8	17.4	9	11.3	30	19.0	4	22.2	—	—	—	—	4	19.0	34	19.0
Brush control and defoliation	16	50.0	13	28.3	11	13.8	40	25.3	7	38.9	—	—	—	—	7	33.3	47	26.3

TABLE 2. ACREAGE SPRAYED IN CANADA IN 1976 DURING EACH AGRICULTURAL ACTIVITY BY OPERATOR GROUP AND REGION

	Commercial			Exemption			Flying Farmers			Commercial and Exemption			Canada		
Activity	Prairies	East & B.C.	Canada	Prairies	East & B.C.	Canada	Prairies	East & B.C.	Canada	Prairies	East & B.C.	Canada	Prairies	East & B.C.	Total
							— acres —								
Weed and plant disease control	748,580	219,655[a]	968,235	457,753	—	457,753	306,111	240[a]	306,351	1,206,333	219,655	1,425,988	1,512,444	219,895	1,732,339
Insect control	109,190	215,036[a]	324,226	45,365	1,600[a]	46,965	25,635[b]	200[a]	25,835	154,555	216,636	371,191	180,190	216,836	397,026
Fertilizing	7,940	77,936[a]	85,876	5,420	—	5,420	535[a]	170[a]	805	13,360	77,936	91,296	13,995	78,106	92,101
Seeding	9,290	3,830[a]	13,120	3,886[a]	—	3,886	320[a]	—	320	13,176	3,830	17,006	13,496	3,830	17,326
Brush control and defoliation	58,232	21,447[a]	79,679	6,336	—	6,336	5,264[b]	—	5,264	64,568	21,447	86,015	69,832	21,447	91,279
Undifferentiated	149,550	—	149,550	80,000	—	80,000	93,960	—	93,960	229,550	—	229,550	323,510	—	323,510
Total	1,082,782	537,904	1,620,686	598,760	1,600	600,360	431,925	610	432,535	1,681,542	539,504	2,221,046	2,113,467	540,114	2,653,581
							— percentage of operator group totals —								
Weed and plant disease control	69.1	40.8	59.7	76.4	—	76.2	70.9	39.3	70.8	71.7	40.7	64.2	71.6	40.7	65.3
Insect control	10.0	40.0	20.0	7.6	100.0	7.8	5.9	32.8	6.0	9.2	40.2	16.7	8.5	40.1	15.0
Fertilizing	0.7	14.5	5.3	0.9	—	0.9	0.2	27.9	0.2	0.8	14.4	4.1	0.7	14.5	3.5
Seeding	0.9	0.7	0.8	0.7	—	0.6	0.1	—	0.1	0.8	0.7	0.8	0.6	0.7	0.7
Brush control and defoliation	5.4	4.0	4.9	1.1	—	1.1	1.2	—	1.2	3.8	4.0	3.9	3.3	4.0	3.4
Undifferentiated	13.8	—	9.2	13.4	—	13.3	21.8	—	21.7	13.7	—	10.3	15.3	—	12.2
Total	99.9[c]	100.0	99.9[c]	100.1[c]	100.0	99.9[c]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.1[c]
							— percentage of total number of acres sprayed for each activity —								
Weed and plant disease control	43.2	12.7	55.9	26.4	—	26.4	17.7	0.01	17.7	69.6	12.7	82.3	87.3	12.7	100.0
Insect control	27.5	54.2	81.7	11.4	0.4	11.4	6.5	0.05	6.5	38.9	54.6	93.5	45.4	54.6	100.0
Fertilizing	8.6	84.6	93.2	5.9	—	5.9	0.7	0.2	0.9	14.5	84.6	99.1	15.2	84.8	100.0
Seeding	53.6	22.1	75.7	22.4	—	22.4	1.8	—	1.8	76.0	22.1	98.2	77.9	22.1	100.0
Brush control and defoliation	63.8	23.5	87.3	6.9	—	6.9	5.8	—	5.8	70.7	23.5	94.2	76.5	23.5	100.0
Undifferentiated	46.2	—	46.2	24.7	—	24.7	29.0	—	29.0	71.0	—	71.0	100.0	—	100.0
Total	40.8	20.3	61.1	22.6	00.6	22.6	16.3	0.02	16.3	63.4	20.3	83.7	79.6	20.4	100.0
							— percentage of total number of acres sprayed in Canada —								
Weed and plant disease control	28.21	8.28	36.49	17.25	—	17.25	11.54	0.01	11.54	45.46	8.28	53.74	56.99	8.28	65.28
Insect control	4.11	8.10	12.22	1.71	0.06	1.77	0.97	.007	0.97	5.82	8.16	13.99	6.79	8.17	14.96
Fertilizing	0.30	2.94	3.24	0.20	—	0.20	0.02	.006	0.03	0.50	2.94	3.44	0.53	2.94	3.47
Seeding	0.35	0.14	0.49	0.15	—	0.15	0.01		0.01	0.50	0.14	0.64	0.51	0.14	0.65
Brush Control and defoliation	2.19	0.14	3.00	0.24	—	0.24	0.20	—	0.20	2.43	0.81	3.24	2.63	0.81	3.44
Undifferentiated	5.64	—	5.64	3.01	—	3.01	3.54	—	3.54	8.65	—	8.65	12.19	—	12.19
Total	40.80	20.27	61.08	22.56	0.06	22.62	16.28	0.02	16.29	63.36	20.33	83.70	79.64	20.34	100.00

[a]Adjusted reported acres.
[b]Adjusted using average for Prairies for flying farmers.
[c]Totals do not add up to 100 percent due to rounding.

TABLE 3. SPEEDS OF OPERATION

Activity	Commercial		Exemption		Flying Farmers	
	Prairies	East & B.C.[a]	Prairies	East & B.C.[a]	Prairies	East & B.C.[a]
			– seconds to fly over one acre –			
Weed and plant disease control	23.5	38.9	32.8	NSD[c]	32.2	NSD
Insect control	24.5	35.0	42.8	NSD	36.2	NSD
Fertilizing	37.8	53.0	46.7[b]	NSD	104.9[b]	NSD
Seeding	46.9	37.8[b]	53.6[b]	NSD	84.7[b]	NSD
Brush control and defoliation	36.0	75.2[b]	95.7	NSD	51.8[b]	NSD
			– acres flown over in one hour –			
Weed and plant disease control	153.1	92.7	111.1	NSD	111.7	NSD
Insect control	147.0	102.7	84.9	NSD	99.6	NSD
Fertilizing	95.2	67.9	77.1[b]	NSD	34.3	NSD
Seeding	76.8	95.3	67.1[b]	NSD	42.5	NSD
Brush control and defoliation	100.0	47.9	37.6	NSD	69.5	NSD

[a]Excludes British Columbia.
[b]Very limited data base.
[c]NSD = not sufficient data base.

operation for the other activities were much lower. For comparable activities, the East and British Columbia generally showed a lower speed of operation than the Prairies.

Commercial operators reported a consistently higher speed of operation than exemption and flying farmer operators. The notable fact, however, is the high speed of operation in all activities, which undoubtedly helps to justify the use of aircraft in farming.

Chemicals

The data contained insufficient detail for drawing conclusions about the association of chemicals, application rates, activities and acreage covered. Operators used a variety of chemicals for most activities. Some general points may nevertheless be made about the applied chemicals.

In weed control, about 47 percent of operators used granular Avadex against wild oats. Application rates ranged from about 12 to 15 pounds per acre. About 28 percent of the operators reported using carbyne, at rates of four to six ounces per acre, and about 12 percent reported using Endaven, at a rate of 16 ounces per acre. For other weeds, 24D at four to eight ounces per acre was by far the most common chemical, reported by about 36 percent of operators. Banvel (one to two ounces per acre), MCPA (five to eight ounces per acre) and LV96 (four to eight ounces per acre) together accounted for about another 30 percent of reports. Against insects, Furadan and Malathion were most commonly used, finding application for most species. To control brush, nearly 50 percent of respondents used 24D in its various forms. Defoliation was almost exclusively accomplished by Reglone.

Custom Rate Per Acre

Comparison of flying costs among operator groups was possible only for the Prairies. It is apparent from the data in Table 4 that the exemption and flying farmer operators charged similar fees, which tended to be slightly below those of the commercial operators. In all cases, the lowest rate was for weed and plant disease control and the highest for brush control. A comparison of commercial operators' charges in the two regions shows that in the East and British Columbia they were nearly twice those in the Prairies, the difference no doubt partially reflecting the lower operation speed in the East and British Columbia.

Type of Aircraft

The above agricultural spray operations were carried out with the aid of over 220 aircraft. Fifty-two percent were specifically designed for aerial spraying – Cessna AgWagons and AgTrucks, Piper Pawnees, Grumman AgCats and Thrush Commanders. Sixty-nine percent of commercial spray operators in the Prairies and 71 percent in the East and British Columbia preferred these types. The only non-agricultural aircraft popular with commercial operators was the Piper Super Cub.

Forty-three percent of both exemption and flying farmer operators used agricultural aircraft extensively

TABLE 4. AVERAGE CHARGE FOR FLYING[a] OVER ONE ACRE

Activity	Commercial		Exemption		Flying Farmers	
	Prairies	East & B.C.	Prairies	East & B.C.	Prairies	East & B.C.
			– $ –			
Weed and plant disease control	1.64	3.34	1.39	NSD	1.47	NSD
Insect control	1.76	3.38	1.60	NSD	1.73	NSD
Fertilizing	1.80	3.66	2.00[c]	NSD	NSD	NSD
Seeding	1.95	4.27[c]	1.58[c]	NSD	1.56[c]	NSD
Brush control and defoliation	2.67[b]	4.03[c]	2.18	NSD	2.25[c]	NSD

[a]Charge for flying only; excludes costs of chemicals.
[b]Excludes two firms whose reported charges far exceed the average.
[c]Small data base.

for spray operations. Dual purpose craft were also popular, notably the Cessna 172 and Piper Super Cub, as were the Aeronca Champion and Boeing Stearman. No other aircraft saw extensive use for spray operations.

OTHER AGRICULTURAL FLYING

Besides in spraying, operators used aircraft for many other agricultural activities, the most frequent of which are grouped in four categories:

Livestock Management

- Checking livestock
- Animal counts
- Livestock searches
- Livestock spotting
- Checking salt licks and water holes
- Fence line patrol
- Checking pastures and range
- Cattle purchase
- Ranch operation

Crop and Land Management

- Crop inspection (weeds and insects)
- Checking land
- Checking crop condition, uniformity and ripening
- Checking crop damage (wind and hail)
- Checking moisture conditions (drainage, wet spots and floods)
- Checking effect of fertilizers
- Checking and chasing birds
- Checking soil conditions
- Checking washouts
- Frost protection
- Checking drainage improvement
- Searching for stray cattle

Farm and Equipment Management

- Transportation for equipment repairs
- Transportation of parts and supplies
- Transportation in equipment purchase
- Transportation in land purchase
- Transportation (general)
- Transportation of farm workers
- Checking buildings, grain bins, hay and straw
- Transportation in farm sales
- Trespasser, hunter and predator patrol
- Surveillance of unattended property in winter

General

- Transportation to agricultural meetings and conventions (various)
  - Farm business (unspecified)
- Checking on progress, methods, etc., of other farms
- Aerial photography for drainage patterns, insect and fertilizer problems

These activities required about 1,300 hours of flying time, most (87 percent) by flying farmers, mainly those living in the Prairies. The greatest emphasis was on land and crop management. Aircraft offer many advantages for these purposes, especially time saving, access when conditions are unsuitable for ground vehicles and the advantages of the aerial viewpoint. Aircraft use in livestock operations was also widely reported, respondents claiming large savings in time over using a truck or a horse or both. They also commented on the visual penetration of brush areas often invisible to a ground observer. Another important use was in maintaining equipment. Many commented on the increasing centralization of supply and service centers, and the unreliability of telephone orders for parts,

missed buses or wrongly dispatched parts causing long and costly delays. The operators reported that aircraft allowed timely access to these centers. They also noted that aircraft were frequently used to transport men and equipment in the farm operation, and in going to meetings and conventions. Many pointed out that such meetings were valuable in improving their farming operations, introducing new ideas, equipment, etc., and claimed that because of the distances involved, their attendance was made possible only by their access to private air transportation.

PROBLEM AREAS

Some respondents expressed concern about taxes on imported aircraft (federal duty, excise and provincial sales taxes) and on aviation fuel for agricultural use. Some considered agricultural aviation, particularly aspects of low flying and night spraying, over-regulated and some under-regulated. Other comments indicated concern about the availability of 80-87 aviation fuel, the lack of training opportunities, the quality of facilities for agricultural aviation, the provision of information to operators and to the public, and aspects of agricultural aviation requiring further research. These are covered fully in the report, which interested readers may consult.

SUMMARY AND CONCLUSIONS

The results of the survey on rural aircraft use for 1976 showed a marked increase in agricultural flying since 1971 in terms of total acres covered and rate of growth. Acreage sprayed increased from approximately 1 million acres to over 2.5 million, and estimates based on the total population of operators suggest that as many as 3.7 million acres were sprayed.

Apart from this dramatic increase in acreage, trends established in previous surveys continued, notably the concentration of rural flying in the Prairies. Not only were the majority (77 percent) of potential operators located here but the percentage of Prairie operators reporting agricultural flying was approximately twice that in the East and British Columbia. Of the 2.5 million acres sprayed, 80 percent were in the Prairies. Similarly, 72 percent of the 20,000 hours flown for spraying were flown in the Prairies. The Prairies remained the region of greater activity, and yet the rate of increase in acreage sprayed since 1971 was larger in the East and British Columbia than in the Prairies.

Commercial operators accounted for 61 percent of the total acreage sprayed, exemption operators 23 percent and flying farmers 16 percent. The predominant activity was weed and plant disease control, but insect control and fertilizing were also important in the East and British Columbia.

Flying time per acre and cost per acre were greater in the East and British Columbia than in the Prairies, reflecting basic differences in agricultural environment. The short flying times per acre reported were generally impressive, and many operators claimed aerial spraying to be economically efficient. Such spraying is perhaps also becoming increasingly professional, with 52 percent of reported aircraft being restricted agricultural aircraft, compared with 40 percent in 1971.

As farmers strive to maximize efficiency to counter the effects of the cost-price squeeze, many more will undoubtedly recognize the benefits of aircraft in their farming operations. Thus the prospect for agricultural flying is one of rapid growth. As use increases, however, so will the need to resolve many of the problems operators mentioned, such as drift control, inadequate training facilities and urban complaints. At the same time farmers will undoubtedly find new uses for what will likely become a common piece of farm machinery. The use of aerial photography in land management is one area which should be explored by farmers.

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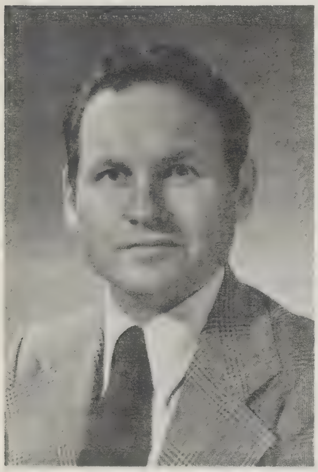
AN ECONOMIC EVALUATION OF DAIRY FARM SYSTEMS IN THE ATLANTIC PROVINCES



T. Campbell Gunn*

A dairy farm system comprises many variables, such as types of equipment and storage facilities for feed, which help determine the economic outcome of the operation. Knowing the economic results of using different types of variables can assist in objectively assessing problems on the farm.

INTRODUCTION

Dairy farm operators can combine livestock, buildings, manure storage, equipment, land, feed storage, labor and management in many ways; a particular combination represents a dairy farm system. Many systems reflecting efforts to improve and expand production have evolved in the Atlantic area. Since farms are usually acquired as production units, modifications are limited by existing constraints and the operators' opinions of how to deal with them. The manner in which production factors are combined significantly influences the economic results. It is not possible or practical to evaluate every dairy system since there are as many systems as there are dairy farmers; some combinations, however, are at least partially common to many dairy farms. Knowing the economic results of alternative combinations can help farmers and extension specialists to more objectively assess problems on the farm.

In 1976, Agriculture Canada conducted a study for the Nova Scotia Department of Agriculture and Marketing to evaluate the economic effects of alternative dairy farm systems, e.g., a system comprising stanchion barns, tower silos and corn silage compared with one comprising free-stall barns, horizontal silos and corn silage. Because all production factors on a dairy farm are interrelated, the study examined the total dairy system rather than only its subsystems. For example, the number of barn days affects the manure handling system, the cropping system, labor and operating capital requirements, etc.

EVALUATION METHODS

In this study, a total dairy farm system consisted of the barn, manure and cropping subsystems, with each subsystem having specific characteristics. Each total system was categorized according to the number of cows. A total dairy farm system could consist of 100 cows, a free-stall barn, double-four milking parlor, solid manure handling system, corn silage stored in a horizontal silo, hay and pasture. A general description of the dairy farm systems evaluated is in Table 1.

Instead of collecting primary data from sample farms, budgeting algorithms comprising research data and information provided by subject matter specialists were used to evaluate the systems. The economic results reflect hypothetical farm units.

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A 1,300-pound cow producing 13,000 pounds of milk a year was used as a standard for all systems. The researchers assumed that herd replacements were purchased, and that when pasture was included in the forage program, cows were housed 220 days a year; otherwise, they were confined for 365 days.

No single computerized model exists in the Atlantic Region for evaluating complete dairy systems, but some models are available to evaluate subsystems and parts of subsystems. These models were used with non-computerized models and the results combined to evaluate the total system. All systems were evaluated on their total annual operating and fixed costs per cow.

In interpreting results, emphasis should be placed on the relative position of the various systems rather than the absolute annual costs of the systems.

CROPPING SUBSYSTEMS

The acreage required for each herd, the crop program and the storage system had to be defined before forage costs per cow could be calculated. This was done by determining daily dry matter consumption, days on feed, cow numbers, storage losses and dry matter yield per acre.

$$\text{Number of acres required} = \frac{\left(\begin{array}{l}\text{Pounds of dry matter} \\ \text{consumed by cow per day} \\ \times \text{ No. of days on feed} \\ \times \text{ No. of cows}\end{array}\right)}{\dfrac{\text{Storage loss factor}}{\text{Dry matter yield per acre}}}$$

The coefficients for determining acreage requirements for the alternative cropping systems are in Table 2.

Having established the number of acres required, harvesting- and storage- cost computerized models were

TABLE 1. DAIRY FARM SYSTEMS AND CHARACTERISTICS OF SUBSYSTEMS

Number of Cows	Barn Subsystem	Manure Subsystem	Cropping Subsystem
40	Stanchion (pipeline)	1. Gutter cleaner 2. Slatted gutter	1. Mow-dried hay and pasture
70	Stanchion (pipeline)	1. Gutter cleaner 2. Slatted gutter	1. Mow-dried hay and pasture 2. Grass silage, hay and pasture 3. Wilted silage and pasture 4. Corn silage, hay and pasture, silage stored in tower silos
70 and 100	Free-stall D-4 milking system	1. Solid manure 2. Slatted floor 3. Liquid manure	1. Mow-dried hay and pasture 2. Grass silage, hay and pasture 3. Wilted silage and pasture 4. Corn silage, hay and pasture, silage stored in tower and horizontal silos
100, 150, 200 and 250	Free-stall D-4 automatic milking system	1. Solid manure 2. Slatted floor 3. Liquid manure	1. Hay[a] 2. Grass silage and hay 3. Wilted silage 4. Corn silage and hay, complete stored system, silage stored in towers and horizontal silos

[a]Hay as the only forage not included in the 150-, 200- and 250-cow systems.

TABLE 2. COEFFICIENTS FOR DETERMINING ACREAGE REQUIREMENTS FOR ALTERNATIVE CROPPING SYSTEMS[a]

Type of Forage	Percent Dry Matter	Dry Matter Yield (lb per acre)	Percent Matter Storage Loss	Dry Matter Consumption (lb per cow per day)
Corn silage	28	6,720	12.9 (TS)[b] 20.2 (HS)[c]	22.0
Grass silage	25	5,000	14.4 (TS) 20.3 (HS)	22.5
Wilted silage	32	5,000	11.9 (TS) 21.5 (HS)	28.2
Hay (with silage fed)	85	4,500	5	4.3
Hay (no silage fed)	85	4,500	5	26.4
Pasture	20	3,500	–	26.0

[a] The storage loss factor for silages is based on a formula developed by Dr. Ray Lassard, a research scientist with the Animal Research Institute, Agriculture Canada, Ottawa. The storage loss factor for hay was provided by Alex Henderson, an agronomist with the N.S. Department of Agriculture and Marketing, Truro, Nova Scotia. Forage dry matter consumption rates and dairy ration feeding rates were provided by Ernest Maynard, Provincial Livestock Superintendent, N.S. Department of Agriculture and Marketing, Truro, Nova Scotia.

[b] TS = tower silo.

[c] HS = horizontal silo.

used to determine crop production costs.[1] Growing costs were established by using non-computerized models.[2] The annual fixed and variable costs per acre for machinery and labor used in the harvesting operation were calculated with the harvesting model. Fixed costs for the silo and silo unloader were not included in the cost calculations for the cropping subsystem, but were included in the storage costs.

A computerized storage cost model was used to calculate the size and cost of the silo required to store each silage crop, and to determine the storage costs per acre while accounting for dry matter storage losses. It was assumed that the harvesting and storing of all forage was well managed and at the same relative stage of maturity, keeping qualitative storage losses minimal, and that cement stave tower silos and cement horizontal silos (without roofs) were used. Hay storage costs were computed by using a dairy barn systems model. Costs not accounted for in the harvesting model and storage cost model include growing costs and those related to silo unloaders. These fixed and variable costs per acre were determined separately. (See Footnote 2.)

Total forage costs per acre were calculated by adding the outputs from the harvesting and storage models to those of the crop growing budget. Pasture costs were computed separately. The costs per acre established for forage and pasture were converted to the cost per cow for each system.

In calculating dairy ration costs per cow, all feed recommendations were based on a 1,300-pound cow producing 13,000 pounds of milk annually. (See Maynard, Footnote a, Table 2.) Assuming a normal lactation curve, dairy ration was fed to balance the nutritional requirements of the cow. Forage quality was assumed to be as follows: corn silage – 8.57 percent crude protein (C.P.), 2.5 percent metabolizable energy (M.E.); grass silage – 10.8 percent C.P., 2.396 percent M.E.; wilted silage – 10.9 percent C.P., 2.462 percent M.E.; hay (as fed) – 10.0 percent C.P., 1.783 percent M.E.; pasture (as fed) – 2.7 percent C.P., 0.599 percent M.E. For a forage program composed of hay and pasture, grass silage, hay and pasture or grass silage and hay, a basic concentrate input of 3,800 pounds of 16-percent dairy ration at $7.70 a cwt was used; for a program consisting of wilted silage and pasture or wilted silage only, 3,500 pounds of an 18-percent dairy ration at $7.95 a cwt; for a program of corn silage, hay and pasture, 2,500 pounds of 20-percent dairy ration at $8.25 a cwt and 1,500 pounds of a 16-percent dairy ration; and for corn silage and hay, 3,800 pounds of a 20-percent dairy ration.

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[1] These models were developed by Dr. James Lovering, an economist, and Allan McIssac, an economic analyst assistant, with the Agriculture Canada Research Station, Charlottetown, Prince Edward Island.

[2] Cash costs for corn silage, grass silage, wilted silage and hay and total costs for pasture production based on current cost per acre budgets were developed by Dr. James Lovering.

TABLE 3. SUMMARY OF ANNUAL FEED COSTS PER COW

Cropping Program	Cows	Hay	Pasture	Grass Silage	Wilted Silage	Corn Silage	Dairy Ration	Total Feed
	– No. –	–			$			–
Hay and pasture	40	263	114	–	–	–	293	670
	70	247	115	–	–	–	293	655
	100	241	114	–	–	–	293	648
Grass silage, hay and pasture	70(TS)[a]	38	115	253	–	–	293	699
	70(HS)[b]	38	115	231	–	–	293	677
	100(TS)	38	114	252	–	–	293	697
	100(HS)	38	114	212	–	–	293	657
Wilted silage and pasture	70(TS)	–	115	–	293	–	278	686
	70(HS)	–	115	–	271	–	278	664
	100(TS)	–	114	–	278	–	278	670
	100(HS)	–	114	–	251	–	278	643
Corn silage, hay and pasture	70(TS)	38	115	–	–	206	314	673
	70(HS)	38	115	–	–	181	314	648
	100(TS)	38	114	–	–	195	314	661
	100(HS)	38	114	–	–	166	314	632

[a]TS = tower silo.
[b]HS = horizontal silo.

BARN SUBSYSTEM

A dairy barn systems model was used to calculate annual costs per cow for feeding, milking and manure handling operations. Costs were included for electricity, fossil fuel, milking labor costs, feeding and manure removal, managing, veterinary services and supplies and fixed costs for buildings and equipment. The fixed costs of the silo and silo unloading equipment were included as part of the crop production costs. These cost calculations were used to determine the economies of alternative feeding, milking and manure handling systems for stanchion and free-stall barns.[3]

The solid manure disposal system for a free-stall barn included a cement storage pad with a six month storage capacity, a scraper to move the manure to the pad and a front-end loader with a conventional spreader to complete removal. For the stanchion barn, a barn cleaner transferred the manure to a cement pad.

The slatted floor and slatted gutter system allow the manure to fall directly into a cement holding tank beneath the barn floor. From there the manure is transferred semi-annually to the field by liquid manure handling equipment. When slatted floors are not part of the free-stall barn, manure is scraped daily to the cement holding tank until transferred to the fields with the liquid manure-handling equipment.

[3]The dairy barn systems model was developed by Gerry Misener, an agricultural engineer with the Agriculture Canada Research Station, Fredericton, New Brunswick.

FEED COSTS

Feed costs are the annual costs per cow for forage plus the annual costs for required dairy ration. With pasture as part of the feeding program, the least-cost feed alternative consisted of hay followed by corn silage and then by wilted silage (Table 3). This relationship remained as long as tower silos were included in the system (Figure 1). At the 70- to 100-cow levels, the corn silage, hay and pasture program was $18 to $13 per cow more costly than the hay and pasture program. When silages were stored in horizontal silos, the least-cost feed alternative was corn silage followed by wilted silage at the 100-cow level. At the 70-cow level, the hay and pasture combination was less costly than the wilted or grass silage program (Figure 2). No penalty was included in the hay costs for possible quality loss due to a prolonged harvest season associated with increased acreage. At the 70-cow level, forage costs, regardless of the type of forage used, were about $22 less when the forage was stored in horizontal silos instead of tower silos and approximately $29 less at the 100-cow level. It is important to consider the total feed package. The cost of growing grass silage was $40 per cow less than that for growing wilted silage.

ANNUAL COW FEED COST COMPARISONS FOR HAY AND PASTURE AND GRASS SILAGE; HAY AND PASTURE; WILTED SILAGE AND PASTURE; AND CORN SILAGE, HAY AND PASTURE

SILAGES STORED IN TOWER SILOS

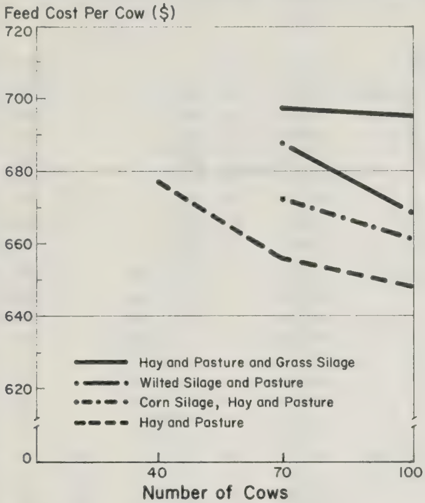

Figure 1

SILAGES STORED IN HORIZONTAL SILOS

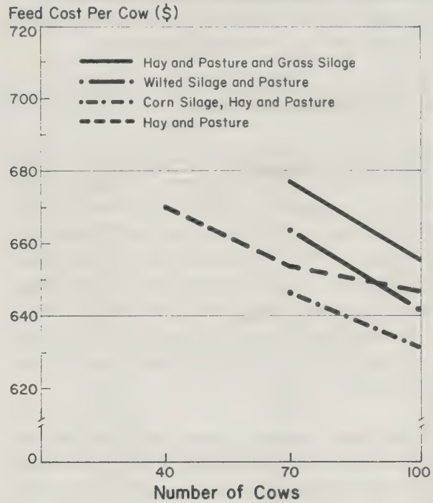

Figure 2

ANNUAL COW FEED COST COMPARISONS - COMPLETE STORED SYSTEM FOR GRASS SILAGE AND HAY; WILTED SILAGE; AND CORN SILAGE AND HAY

SILAGES STORED IN TOWER SILOS

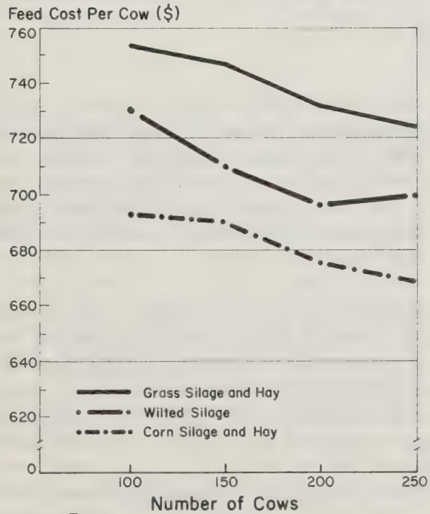

Figure 3

SILAGES STORED IN HORIZONTAL SILOS

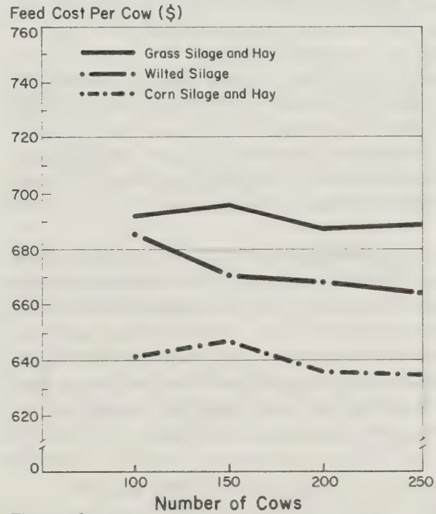

Figure 4

In addition to the grass silage, the dairy ration and hay requirements offset the $40 per cow savings, making them more expensive by approximately $13 per cow. When corn silage was fed, more dairy ration was needed to balance it; however, the lower cost per cow for the forage package offsets this higher requirement to make it the least costly package of the silage programs.

COMPLETE STORED FEED

A complete stored system was considered to be one in which the cows were in confinement 365 days a year with forages in storage. The 100-cow level was the only one in which hay was considered the only forage in a complete stored system. At this level, hay was less costly than grass silage or wilted silage regardless of the storage system used but more costly than corn silage stored in horizontal silos. No attempt was made to discount hay quality because of the high acreage requirement for this herd size (Table 4).

When silages were stored in tower silos, the least-cost feed package was corn silage and hay followed by wilted silage, and then by grass silage and hay (Figure 3). Total feed costs were about $60 per cow less for corn silage and hay than for grass silage and hay. When silages were stored in horizontal silos, the results were the same as above (Figure 4). Because of investment requirements, costs did not decrease uniformly as cow numbers increased. The cost spread between corn silage and hay, and grass silage and hay was approximately $50 per cow in favor of corn silage and hay. Corn silage was a component of the least-cost feed package because corn has a higher dry matter yield per acre than the other forages. When corn silage is fed, more dairy ration is needed to balance the feeding program. The additional ration costs, however, were not great enough to offset the savings in growing and storage costs.

The least-cost feed alternative, regardless of crop or cow numbers, included horizontal silos. This cost advantage varied from $31 to $61 per cow depending on the crop and the number of cows. In the 100-cow unit, the advantage ranged from $46 to $61, while in the 250-cow unit, the advantage ranged from $31 to $37. The higher figures were for grass silage and the lower figures for corn silage, with wilted silage in between.

SUMMARY OF BARN SYSTEMS COSTS

The barn systems are summarized according to cropping programs because of the latters' influence on the barn system cost. The number of confinement days, for example, influences the feeding and manure handling costs. The annual costs per cow with the stanchion barn system were higher than those with the free-stall (Table 5). The margin of difference was over $85 per cow based on the 70-cow herd size. The main reasons for this were higher labor, building and equipment costs. Stanchion barns were not evaluated under a complete stored feed system.

TABLE 4. ANNUAL PER COW FEED COST COMPARISON FOR COMPLETE STORED SYSTEMS

Cropping Program	Cows	Hay	Grass Silage	Wilted Silage	Corn Silage	Dairy Ration	Total Feed
	– No. –	–			$		–
Hay	100	374	–	–	–	293	667
Grass silage and hay	100(TS)[a]	64	397	–	–	293	754
	100(HS)[b]	64	336	–	–	293	693
	150(TS)	72	382	–	–	293	747
	150(HS)	72	332	–	–	293	697
	200(TS)	68	372	–	–	293	733
	200(HS)	68	327	–	–	293	688
	250(TS)	67	367	–	–	293	727
	250(HS)	67	330	–	–	293	690
Wilted silage	100(TS)	–	–	452	–	278	730
	100(HS)	–	–	406	–	278	684
	150(TS)	–	–	432	–	278	710
	150(HS)	–	–	393	–	278	671
	200(TS)	–	–	420	–	278	698
	200(HS)	–	–	393	–	278	671
	250(TS)	–	–	423	–	278	701
	250(HS)	–	–	388	–	278	666
Corn silage and hay	100(TS)	64	–	–	316	314	694
	100(HS)	64	–	–	264	314	642
	150(TS)	72	–	–	304	314	690
	150(HS)	72	–	–	261	314	647
	200(TS)	68	–	–	294	314	676
	200(HS)	68	–	–	256	314	638
	250(TS)	67	–	–	287	314	668
	250(HS)	67	–	–	256	314	637

[a]TS = tower silo.
[b]HS = horizontal silo.

Free-stall barns were evaluated for 100- to 250-cow herds under a total confinement setup, with a $70 per cow spread in annual operating and fixed costs between cow levels (Table 6). The biggest advantage in economies of size took place between 100 and 150 cows (Figure 5). Approximately 66 percent of the $70 differential ($46) occurred between 100 and 150 cows whereas only 13 percent ($9) took place between the 200 and 250 levels.

The barn system with solid manure disposal was the least costly for all herd sizes considered. For 70- to 250- cow herds housed in free stalls, there was little difference in

TABLE 5. SUMMARY OF ANNUAL OPERATING AND FIXED COSTS PER COW FOR ALTERNATIVE BARN SYSTEMS, PASTURE INCLUDED IN FORAGE PROGRAM

Barn System	Cows	Manure System	Hay and Pasture	Grass Silage, Hay and Pasture	Wilted Silage and Pasture	Corn Silage and Pasture
	– No. –		–		$	–
Stanchion Barn	40	SM[c]	621	–	–	–
(pipeline and	40	SG[d]	615	–	–	–
feed carts)	70	SM	527	–	–	–
	70	SG	524	–	–	–
	70(TS)[a]	SM	–	559	550	559
	70(TS)	SG	–	554	545	554
Free-stall	70(TS)	SM	–	441	433	439
D-4 milking system	70(HS)[b]	SM	–	446	439	445
Mechanical	70(TS)	SF[e]	–	470	463	468
feeders (TS)	70(HS)	SF	–	475	468	475
Silage wagons (HS)	70(TS)	LM[f]	–	468	461	467
	70(HS)	LM	–	474	467	473
	100	SM	385	–	–	–
	100	SF	422	–	–	–
	100	LM	419	–	–	–
	100(TS)	SM	–	396	388	394
	100(HS)	SM	–	396	389	395
	100(TS)	SF	–	433	425	431
	100(HS)	SF	–	433	426	432
	100(TS)	LM	–	430	423	429
	100(HS)	LM	–	431	423	430

[a]TS = tower silo.
[b]HS = horizontal silo.
[c]SM = solid manure.
[d]SG = slatted gutter.
[e]SF = slatted floor.
[f]LM = liquid manure.

annual costs between the slatted floor and liquid manure arrangements (Figure 6). The solid manure system was the most economical, mainly because of lower investment costs. At the 100-cow level, it required about $10,000 less investment than the liquid manure system and about $21,000 less than the slatted floor system. Little difference existed in total costs between the slatted floor system and liquid system chiefly because the lower capital investment in the liquid system was offset by the higher labor costs needed to operate it. Specifically, the liquid manure system required about $10,000 to $11,000 less initial investment but needed about 232 additional hours to operate it, mainly because of the scraping function.

For the stanchion barn, there was little difference in the costs for the slatted gutter and the conventional manure systems. The slatted gutter had slightly lower costs of $3 to $6 per cow (Table 5) and had a higher initial investment, but this was offset by lower labor costs.

SUMMARY OF TOTAL COSTS PER COW

The total annual cost per cow comprises the feed and barn system costs. Of the herd sizes evaluated and housed in the stanchion barn system, the least expensive on an annual cost per cow basis was the 70-cow herd with a slatted gutter manure system and a hay and pasture forage system (Table 6). When silage was part of the feed package, the least cost forage was corn silage.

When stanchion and free-stall barns are compared with different silage and pasture systems, the least annual cost per cow is the free-stall barn with solid manure system, horizontal silo and corn silage as the main forage ingredient. The spread in annual costs is $134 per cow.

For the 70-cow herd housed in a stanchion barn, the hay and pasture feed system is the least costly. For the 100-cow herd with a free-stall arrangement, the hay and pasture system is the least costly of any pasture and

TABLE 6. SUMMARY OF ANNUAL OPERATING AND FIXED COSTS PER COW FOR ALTERNATIVE BARN SYSTEMS, WITH COWS ON COMPLETE STORED FEED

Barn System	Cows	Manure System	Hay	Grass Silage and Hay	Wilted Silage	Corn Silage and Hay
	— No. —		—		$	—
Free-stall	100	SM[c]	404	–	–	–
D-4 milking system	100	SF[d]	431	–	–	–
Mechanical	100	LM[e]	433	–	–	–
feeders (TS)	100(TS)[a]	SM	–	422	407	419
Silage wagons (HS)	100(HS)[b]	SM	–	419	405	419
	100(TS)	SF	–	449	435	446
	100(HS)	SF	–	447	443	446
	100(TS)	LM	–	451	437	448
	100(HS)	LM	–	449	435	448
	150(TS)	SM	–	376	362	373
	150(HS)	SM	–	368	355	367
	150(TS)	SF	–	407	394	404
	150(HS)	SF	–	400	387	399
	150(TS)	LM	–	408	395	405
	150(HS)	LM	–	401	388	400
	200(TS)	SM	–	361	347	358
	200(HS)	SM	–	352	339	351
	200(TS)	SF	–	387	374	384
	200(HS)	SF	–	379	366	378
	200(TS)	LM	–	388	375	385
	200(HS)	LM	–	379	366	378
	250(TS)	SM	–	352	337	349
	250(HS)	SM	–	341	327	340
	250(TS)	SF	–	377	362	374
	250(HS)	SF	–	366	352	365
	250(TS)	LM	–	377	363	374
	250(HS)	LM	–	367	353	365

[a]TS = tower silo.
[b]HS = horizontal silo.
[c]SM = solid manure.
[d]SF = slatted floor.
[e]LM = liquid manure.

TABLE 7. SUMMARY OF TOTAL ANNUAL OPERATING AND FIXED COSTS PER COW FOR ALTERNATIVE BARN AND FORAGE SYSTEMS WITH PASTURE INCLUDED IN FORAGE SYSTEM

Barn System	Cows	Manure System	Hay and Pasture	Grass Silage, Hay and Pasture	Wilted Silage and Pasture	Corn Silage and Pasture
	– No. –		–		$	–
Stanchion Barn	40	SM[c]	1,291	–	–	–
(pipeline and	40	SG[d]	1,285	–	–	–
feed carts)	70	SM	1,182	–	–	–
	70	SG	1,179	–	–	–
	70(TS)[a]	SM	–	1,258	1,236	1,232
	70(TS)	SG	–	1,253	1,231	1,227
Free-stall	70(TS)	SM	–	1,140	1,119	1,112
D-4 milking system	70(HS)[b]	SM	–	1,123	1,103	1,093
Mechanical	70(TS)	SF[e]	–	1,169	1,149	1,141
feeders (TS)	70(HS)	SF	–	1,152	1,132	1,123
Silage wagons (HS)	70(TS)	LM[f]	–	1,167	1,147	1,140
	70(HS)	LM	–	1,151	1,131	1,121
	100	SM	1,033	–	–	–
	100	SF	1,070	–	–	–
	100	LM	1,067	–	–	–
	100(TS)	SM	–	1,093	1,058	1,055
	100(HS)	SM	–	1,053	1,032	1,027
	100(TS)	SF	–	1,130	1,095	1,092
	100(HS)	SF	–	1,090	1,069	1,064
	100(TS)	LM	–	1,127	1,093	1,090
	100(HS)	LM	–	1,088	1,066	1,062

[a]TS = tower silo.
[b]HS = horizontal silo.
[c]SM = solid manure.
[d]SG = slatted gutter.
[e]SF = slatted floor.
[f]LM = liquid manure.

TABLE 8. SUMMARY OF TOTAL ANNUAL OPERATING AND FIXED COSTS PER COW FOR ALTERNATIVE BARN AND FORAGE SYSTEMS WITH COWS ON COMPLETE STORED FEED

Barn System	Cows	Manure System	Hay	Grass Silage and Hay	Wilted Silage	Corn Silage and Hay
	– No. –		–		$	–
Free-stall	100	SM[c]	1,071	–	–	–
D-4 milking system	100	SF[d]	1,098	–	–	–
Mechanical	100	LM[e]	1,100	–	–	–
feeders (TS)	100(TS)[a]	SM	–	1,176	1,137	1,113
Silage wagons (HS)	100(HS)[b]	SM	–	1,112	1,089	1,061
	100(TS)	SF	–	1,203	1,165	1,140
	100(HS)	SF	–	1,140	1,127	1,088
	100(TS)	LM	–	1,205	1,167	1,142
	100(HS)	LM	–	1,142	1,119	1,090
	150(TS)	SM	–	1,123	1,072	1,063
	150(HS)	SM	–	1,065	1,026	1,014
	150(TS)	SF	–	1,154	1,104	1,094
	150(HS)	SF	–	1,097	1,058	1,046
	150(TS)	LM	–	1,155	1,105	1,095
	150(HS)	LM	–	1,098	1,059	1,047
	200(TS)	SM	–	1,094	1,045	1,034
	200(HS)	SM	–	1,040	1,010	989
	200(TS)	SF	–	1,120	1,072	1,060
	200(HS)	SF	–	1,067	1,037	1,016
	200(TS)	LM	–	1,121	1,073	1,061
	200(HS)	LM	–	1,067	1,037	1,016
	250(TS)	SM	–	1,079	1,038	1,017
	250(HS)	SM	–	1,031	993	977
	250(TS)	SF	–	1,104	1,063	1,042
	250(HS)	SF	–	1,056	1,018	1,002
	250(TS)	LM	–	1,104	1,064	1,042
	250(HS)	LM	–	1,057	1,019	1,002

[a]TS = tower silo.
[b]HS = horizontal silo.
[c]SM = solid manure.
[d]SF = slatted floor.
[e]LM = liquid manure.

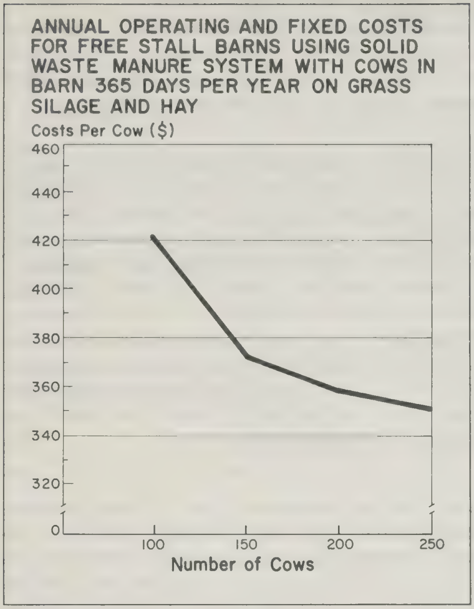

Figure 5

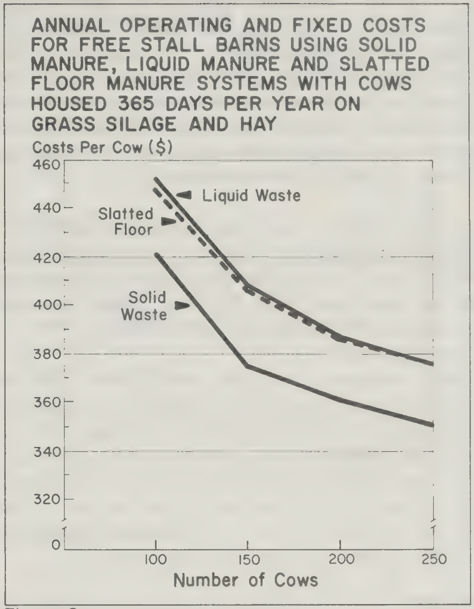

Figure 6

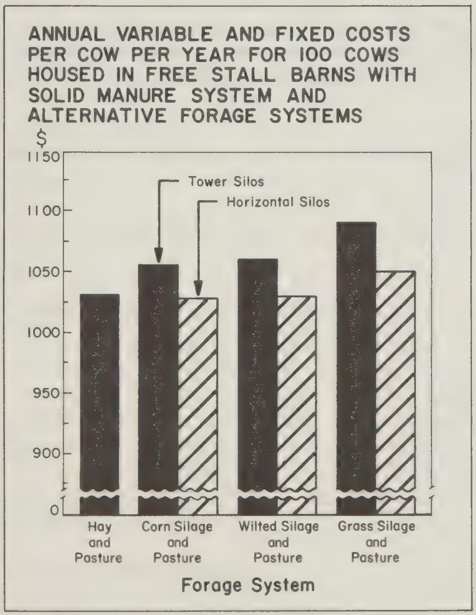

Figure 7

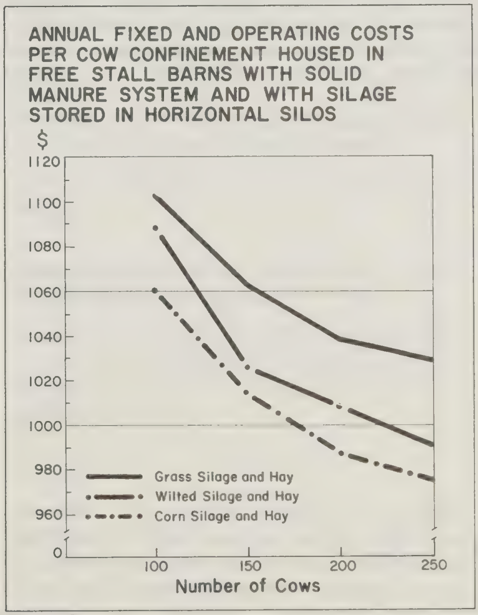

Figure 8

silage system when tower silos are used. The margin is \$20 to \$60 per cow, the lower figure being for corn silage and the higher figure for grass silage. When horizontal silos are used, the corn silage and pasture, and wilted silage and pasture systems are less expensive than hay alone by \$1 to \$6 per cow. Corn silage is the least costly. Grass silage is more expensive than the hay system by about \$20 per cow (Figure 7).

For the 100-cow herd in year-round confinement housing, the hay system is less costly than grass silage or wilted silage but more expensive than corn silage stored in horizontal silos (Table 7). If corn silage is stored in tower silos, the hay system is the least costly.

When considering a complete stored system, the least cost package was for the 250-cow herd using a free-stall, solid manure system and feeding corn silage and hay with the silage stored in a horizontal silo. The annual fixed and variable costs per cow at this level and with this system was \$977 per cow, \$84 per cow less than for the 100-cow herd (Figure 8). The economies of size were similar regardless of forage and storage systems.

For any system, the difference between the most and least expensive system was quite significant. For the 100-cow herd with year-round confinement and silage as the main feed source, the difference was \$144 per cow. The least expensive system included a free-stall barn, a solid manure disposal system and corn silage and hay as the feeding program with silage stored in a horizontal silo. The most costly system consisted of a free-stall barn, a liquid manure disposal system and a feed package of grass silage and hay with the silage stored in a tower silo. No effort was made to assess the effect of different systems and managers' bias on milk production.

Conditions to some extent dictate the type of system. Cow numbers dictate whether silage or hay is to be the basic forage system. In high precipitation areas, it is difficult to get a reasonable quality of hay harvested for over 75 cows. Beyond this number, silage is usually used to maintain nutritional quality. The location may also dictate the type of silage program. If it is a corn growing area and land is scarce and suitable, corn silage should be grown. If these conditions do not exist for corn silage, then wilted silage or grass silage is recommended as the forage. Based on this study, wilted silage would take precedence over grass silage.

From labor and investment points of view, stanchion barns have their limitations for herds of 70 or more. The data in this study indicate that stanchion barns are about \$105 to \$120 per cow more costly per year than the free-stall type at the 70-cow level. Above this number, free-stalls are necessary if for no other reason than the ability to handle large numbers of cattle.

In summary, even though certain systems show up as being the least costly, the manager and the location must be considered in the recommendations.

NATIONAL FOOD STRATEGY

A food strategy conference was held on February 22-23, 1978, in Ottawa. Approximately 500 delegates and observers exchanged views and shared information in a spirit of consultation, co-operation and respect. All the major groups involved in food production, processing, distribution, retailing, nutrition, safety, regulation and consumption were represented, as well as eleven federal departments.

Delegates and observers were divided into six workshops. These were reduced to small groups or syndicates to aid discussion and individual participation.

The six reports of the workshop reporters are presented below for the benefit and convenience of CFE readers.

WORKSHOP ON INCOME SUPPORT AND STABILIZATION

Chairman – Dr. G.I. Trant, Secretary – Mr. C.F. Brouillard, Recorder – Mr. J.-M. Kirouac

The participants were of the general opinion that farm producers and fishermen have suffered in the past because of income weakness and instability.

Participants in the five workshops of task force No. 1 reached a consensus on the need for income stabilization programs.

Debate surrounding this theme focused on the following items:

1. **Agricultural Efficiency and Productivity**

   It was generally recognized that gains in productivity should not come at the expense of producer income. The benefits of increased productivity both in agriculture and of the other agents in the food chain should be shared equally by all Canadians. Income stabilization programs should be designed on the basis of the performance of efficient producers.

2. **Income of Farm Producers**

   The task force was of the opinion that farm income should be comparable (mutatis mutandis) with the income in the other sectors of economic activity.

   Everyone agreed that stabilization programs must guarantee greater income stability and security for fishermen and farm producers.

3. **Price of Food**

   Participants tried in vain to define what might be considered a fair price for food.

   Some proposed that there should be a relationship between the price of farm products and consumer purchasing power.

   Others acknowledged that the price of food should be such that each of the agents in the food chain is able to obtain an income proportional to the services rendered.

4. **Marginal Producers**

   Participants were of the general opinion that income stabilization programs are not designed for marginal producers even though these programs provide some support, albeit inadequate to enable such producers to reach the economic break-even point.

   Other measures will be necessary to improve the situation of the low-income producer.

5. **Harmony of Federal and Provincial Income Stabilization Programs for Farm Producers**

   All participants hoped to see a rapid solution to this problem.

6. **Financial Participation of Farm Producers in Farm Income Stabilization Program**

   The formula whereby producers would participate in income stabilization and support programs received the unanimous approval of task force members.

7. **Resources**

   Members of the task force agreed on the need for programs to complement the income support and stabilization programs designed for farmers and fishermen. These complementary programs would involve crop insurance, production research, livestock and crop disease control and provision for adequate farm credit.

8. **Marketing Boards**

   The task force supported the existence and use of marketing boards. Some members of the task force indicated that they had difficulties with the concept of supply management.

9. **Foreign Competition**

   The task force workshops agreed on the need to provide the Canadian market with short- and long-term protection, subject to a cost-profit analysis to determine the long-term viability of the producers receiving protection.

10. **Foreign Markets**

    The task force quickly agreed on the advisability of improving our export market for farm and fish products.

Follow-up to Conference

The task force considered that there should be a follow-up to the conference. There was unanimity on the need for future consultation. On the other hand, the workshops could not reach agreement on the means of bringing about this consultation.

WORKSHOP ON MARKETING AND FOOD AID

Chairman – Mr. M.J. Heney, Secretary – Mr. H.R. Migie, Recorder – Mrs. M. Brechin

Market Information

Agreement was reached on the following items:

1. Producers lack knowledge of sources of information and analytical services. Statistics are abundant but useful market information is not.

2. Producers need more information on governmental policy at all levels relative to decisions which affect the market.

3. Exchange of information among groups must be improved.

4. It is essential to improve the information base for all commodities and particularly for those under supply management.

5. Consumers must have information on food quality and nutritive value to make choices. Some of this may be supplied by grading standards and labelling.

6. To be useful, information to consumers must be relevant, well prepared, simple and easily understood.

It was recommended that government funds now used to collect the market basket information be examined to determine if they could be used more effectively and the Department of Consumer and Corporate Affairs should concentrate on providing sufficient competition in the food system in their Competition Policy.

Price Determination

It was agreed that the public interest should be represented on supervisory bodies of marketing boards.

While the workshop recognizes that we live in a market economy it was agreed that producers have the right to organize to market a commodity.

Marketing boards which exercise price-setting functions require supervision by a body having the ability to monitor and reverse decisions when necessary. (The NFU agrees only if it applies to all sections of the food system.)

Respecting first receivership of imports under quota, it was agreed that import control must remain with a federal agency and that monopoly by boards or private interests be regulated. (The Consumers Association of Canada feels that monopoly control of imports must be avoided.)

Within the context of national unity, one syndicate deplores the provincialism inherent in commitments to provincial self-sufficiency in agricultural production.

One syndicate agreed that "Cost of production rights should not be considered as a cost of production."

Transportation

It was agreed that food policy should include consideration of a revised transportation policy to take into account regional problems in Canada, differences in provincial regulations and the interests of all participants in the food system.

Export Development

Exports should be developed nationally. Provinces should not compete with each other.

The constraints and opportunities of international arrangements (e.g., GATT) must be recognized.

Canada should concentrate on those products which can be exported profitably.

It is recommended that a study be undertaken on the impact of multinational ownership of food processing on the food exports from their Canadian plants.

Food Aid

It was agreed that workshop participants do the following:

1. Support the statement in the food strategy.

2. Place greater emphasis on development of indigenous capability to generate their own food supplies.

3. Have a larger Canadian role in providing prompt food aid in disaster situations.

It was suggested that domestic food aid should be a firm and essential part of food policy and that skim milk powder should be used to improve poor nutrition situations of pregnant women.

Half of the syndicates agreed that food aid should be provided on the basis of nutritional requirements of the recipient countries and not be seen as a means of disposing of surplus commodities.

Consultative Process

It was agreed that there is a need for a forum (or mechanism) to allow consultation and information exchange. Recognizing that we cannot design the optimum form of such a mechanism it was suggested that associations rather than individuals be represented, that independence be stressed and research capability be available.

There is a need for continuing consultation among organizations on specific issues. The workshop also recognized the need for consultation by all sectors of the food industry on interrelated issues in food policy development.

WORKSHOP ON RESEARCH, INFORMATION AND EDUCATION

Chairman – Dr. A.B. Morrison, Secretary – Mr. B.L. Smith, Recorder – Mr. B.P. Turcot

There was general agreement that the government working document "A Food Strategy for Canada" failed to focus sufficient attention on human nutrition and food safety. Nutritional considerations must be part of decision making at all points in the food system. Long-term effects on human health of changing dietary habits and consumption patterns must be evaluated carefully.

The group addressed itself to identifying research, information and education needs.

It was felt that more plant and animal research, including the development of improved strains, should be a priority.

While some members of the group thought that more research is needed on new foods (i.e., fabricated, substitute foods), others believed that research activity should be directed into development of new foods. Most thought that in the development of new foods, care must be taken that nutritional and safety considerations are not compromised.

It was stressed that increased emphasis is needed in the area of product, processing and human nutrition research while maintaining the present base in agricultural production research.

The following areas were considered to have high priority:

1. research into less energy intensive processing and production methods including energy costs in the food system;

2. research into the economic aspect of food wastage and the utilization of waste products;

3. marketability of nutritional information to target groups, including motivational research needed as a basis for effective nutrition education programs;

4. research into food safety, including long-term effects on human health of chemicals in foods and

5. research on transportation and storage, and their effects on nutritional value, safety and costs of foods.

In terms of research strategies, the group felt strongly that governments should reaffirm their commitment, as a wise Canadian investment, to assure a national

long-term availability of adequate facilities and expertise in food research. This would include the maintenance of regional research facilities as appropriate and adequate manpower planning for the future.

Research related to product development, marketing and similar areas should be seen primarily as the responsibility of the private sector, although government assistance and incentives may be needed to promote these activities.

Support of mission oriented research on food production, human nutrition and food safety, and so-called curiosity research aimed at increasing the fundamental information base should, mainly, remain a major responsibility of the public sector, including governments and universities. Public sector commitment to research must be of a continuing long-term nature, to attract and hold first-rate scientists.

In the area of information and education needs, it was suggested that nutrition programs should be expanded from kindergarten through high school and into professional education. It was also suggested that more emphasis on nutrition education be addressed to the food service sector. While recognizing that education is a provincial responsibility it was noted that federal coordination is desirable.

The group felt that all sectors of the food system should have a common understanding of educational needs and goals. This would tend to change the orientation of much public information related to foods which tends to be supplier based rather than inquiry based. Furthermore, there should be an effort to establish appropriate relationships between food policy and social programs, particularly disadvantaged groups within the population.

There should be a continuing re-evaluation and rationalization of government regulations to facilitate the introduction of new and improved foods without compromising nutritional quality and food safety. Experience in other countries should be examined for its relevance to the Canadian situation.

The workshop recognized the necessity of continued and expanded dialogue and consultation between all segments of the food system.

It was recommended that an appropriate mechanism be established to facilitate such consultation. Such a mechanism should incorporate the following elements:

1. representation and funding from the private and public sectors of the food system, including consumers;

2. a reporting relationship to, but independent from, the federal government and

3. a capacity to provide advice to various segments of the food system, including governments, producer processors, distributors and consumers on future policies and to evaluate current policies and programs.

It was suggested that information of a national food and nutrition council could provide the means by which these objectives could be met. The purpose of such expanded and continuing consultation must be to assist government in the development and implementation of an integrated food and nutrition policy.

In addition, coordination among government departments making and executing food policy needs to be improved. Responsibility for such improvement lies within the machinery of government.

WORKSHOP ON TRADE POLICY AND SAFEGUARDS

Chairman – Mr. A. Guérin, Secretary – Mr. C. Craddock, Recorder – Mr. C. Friend

There was general agreement that Canada's trade policy should ensure a healthy and diversified food industry with safeguards beyond production of commodities in which we are competitive in the long run. There should be protection to ensure production of commodities which are both essential to fulfill Canadian consumption requirements and guard against external disruptions. While Canadians need to be assured of adequate supplies, we should also fulfill any developed export markets. In addition, trade policies should provide consumers with products at reasonable prices while ensuring access to nutritional foods.

It was also felt that Canada's trade policy should guard against short-term disruptions in world markets. Safeguards which could be employed include surtaxes and import quotas. These safeguards should have a trigger mechanism which would be automatic, quick and efficient. Any adjustment assistance to offset short-term disruptions should be maintained only for a limited time.

In addition, the trade policy should take into account the longer-term problems of commodities which warrant special consideration, using the criteria of nutritional value, potential for growth to supply both the domestic and export markets, value of production of the commodity in meeting other national goals, continuity of historical and regional patterns of production and the need to retain the agricultural use of important land resources.

The majority felt that the present system of controlling beef imports, should be retained as opposed to the introduction of special legislation, that marketing boards with supply management powers should be granted first receivership rights to maintain orderly marketing, recognizing that a monitoring mechanism would be required to protect against abuses and that trade in agricultural products should continue to be consistent with a policy of self-reliance.

There was a general consensus that Canada should seek better access to foreign markets. Such access should be consistent with the objective of obtaining reciprocity while at the same time maintaining built-in-safeguards to guard against short-term market disruptions and that Canada has benefited in belonging to international commodity arrangements through increased price stability and improved discipline in international trade.

Concern was expressed about the effect of tariffs and non-tariff barriers on the cost of inputs for the primary producer. Although most major farm inputs are now on a duty-free basis, tariffs and non-tariff barriers may increase the production costs for sectors using specialized equipment (e.g., small tractors, tree planters and containers). Concern was also expressed about the effect of tariff and non-tariff barriers on the input costs of the processing industry.

There was a consensus that further consultations involving all participants in the food system should take place. It was recommended that a small steering committee composed of the key elements in the food system be formed. This committee would determine the appropriate mechanisms for future consultations. In addition, there was a majority view that a conference similar, but longer than the present one, be convened for early 1979. The workshop also recommended that the information flow now taking place between the government and participants in the food sector be maintained. This broad consultative process is not intended to replace the current mechanisms for consultations between interest groups and appropriate government departments.

WORKSHOP ON PROCESSING, DISTRIBUTION AND RETAILING

Chairman – Dr. C. Blackwood, Secretary – Mr. J. Montgomery, Recorder – Mr. K. Campbell

Productivity and Efficiency

It was generally felt that the processing, distribution and retailing (PDR) sector operates at a reasonable level of productivity and efficiency. The following were identified as areas for improvement.

A. Research

1. The importance of research and development in the food sector in achieving high levels of productivity and efficiency was recognized.

2. Of primary importance is the establishment of criteria for the measurement of productivity, efficiency and performance.

3. Government research priorities should be determined in consultation with users and the results should be available to all, including producers and the public. Indeed the group identified, as a major problem, the lack of communication of the results of research.

4. The need to increase the level of research in food technology and marketing was emphasized.

5. A constraint on research by the private sector is the difficulty of exclusive use of the results to capitalize on the investment. The suggestion was offered that the federal government support local research centers similar to the advanced centers of technology funded by Industry, Trade and Commerce (IT&C), but less restricted in terms of funding.

B. Data Base

1. It was felt that there are gaps in the data base in some segments of the PDR sector, e.g., the flow of specific products through the various trade channels.

2. Unnecessary data gathering is expensive. Therefore, requirements must be related to specific and identified needs. Duplication of data gathering must be minimized and consultation should take place between gatherers and users.

C. Nutritional Principles

1. It was agreed that there is a need for the education of consumers in the nutritional value of food. Such a program would go a long way in solving many nutritional deficiencies in the Canadian diet.

2. It was also felt that such a program would be preferable to regulated nutritional labelling. This is not to say that nutritional labelling should be discouraged. In fact, it was suggested that manufacturers and processors should make available accurate and understandable information on the nutritional value of their products. Nutritional information should be available in a form useful to the consumer.

D. Packaging

1. Productivity gains should result from a reduction in the numbers of package sizes. It was noted that this process was already underway and metrication will speed it up. There would still remain the need for an adequate range of sizes.

2. Productivity could be improved by avoiding over-elaborate packaging and using where possible (in terms of economics and sanitation) re-usable packages.

3. It is important that packaging material adequately protect nutritive qualities of food. This is an area where additional research is required.

E. Transportation System

1. The key to a food policy is an efficient and adequate transportation system.

2. The problem of empty back-hauls in the trucking industry was noted. In some cases, this results from provincial regulations. In the rail sector also, trade patterns and practices often result in empty cars on return trips.

3. There was concern about the transportation industry's ability to handle perishables.

4. Plant location in relation to raw material supply and cost of transportation (including energy) requires further study, in the context of changing energy costs.

F. Business Climate

1. Business presently lacks confidence in the economy, a condition which has been exacerbated by a fear of increased government intervention.

2. It must be recognized that adequate profit level is a prerequisite to a stable business environment and a viable PDR sector.

3. Lack of capital at reasonable rates of interest was identified as a constraint to taking advantage of latest advances in technology to improve productivity.

4. Government should consider the effects of its regulations on costs and productivity and conduct cost-benefit analysis of new regulations.

G. Government Assistance and Incentive Programs

1. Government assistance is still required for regional equalization. However, some feel that government assistance has been overdone. This has interfered with the free operation of market forces.

2. DREE grants should not be made without a detailed economic study of the impact on existing industry in other regions.

3. It was suggested that government should explore the use of coupons to help low-income people obtain basic foods.

Interrelationships

It is imperative to realize that the PDR sector is an integral part of the food system.

There must be an interface between the parts of the PDR sector and between them and consumers and producers, including their marketing agencies.

It was suggested that the industry associations should provide the vehicle for this in a systematic way.

Farmers are concerned that there is a tendency on the part of the public to identify costs of food only with the farmer.

Concern was expressed that small processing business in particular, lacks technically trained people and access to technology.

It is recognized that seasonality adversely affects productivity of the industry.

It was noted that sophisticated processed products should complement rather than replace basic less-processed products so that consumers have the choice of price levels.

There is a need for training programs in proper handling and quality control for retail employees.

Competition

Parts of the group felt that competition is not only sufficient but is intense, even to the point of having eliminated smaller entrepreneurs at the wholesale and retail levels. Others in the group felt that there are varying degrees of competition in different regions of the country and in discrete markets, and that this is reflected in different pricing policies between markets. It was suggested, therefore, that the effects (whether positive or negative) of competition and concentration of power in one section of the PDR sector on the other sectors, and also on producers and consumers, require investigation and explanation. This study should include the effect of marketing boards on competition.

It was noted that the competitive position of Canada's food industry in international markets has been adversely affected by input costs.

It was suggested that the Economic Council of Canada should carry out a research and study program on the degree of competition and economic performance of the PDR sector. In addition, they should consider the need for on-going research and monitoring and who should do it.

Role of Government

Unfortunately, time did not permit an adequate discussion of the various points raised by the syndicates. The following is a cross section of the views expressed.

1. Incentives to develop processing close to raw material sources are needed.
2. Consider encouragement of investment by joint ventures.
3. Restrict imports to a planned ratio so that market fluctuation can be smoothed.
4. Develop and improve bulk material transportation, storage and handling facilities.
5. Information on transport costs as they affect consumer prices is required.
6. Encouragement of a healthy food industry and assurance of an adequate food information system.
7. There is a need for greater dialogue between sectors by setting up regional food councils and a national council.
8. Coordinate the requirements of the various government departments.
9. Provide information on the food system and food prices.
10. Revise the Consumer Price Index (CPI) to reflect actual cost of living and combine with average monthly wages to create a consumer status index. This could have the effect of moderating expectations.
11. Government and industry should work together to popularize nutritive value of basic foods to low income families.
12. Clarification is required on governments' intention as stated.
13. Government should take the leadership in encouraging and should financially support consumer cooperatives in teaching nutrition to consumers with low incomes in disadvantaged areas.
14. Place the food industry as a priority in IT&C's enterprise development program.
15. The question of importing workers for harvesting was raised. It was suggested that it should be permitted whenever circumstances require.
16. Conflict between federal and provincial regulations was raised; this needs further clarification.
17. Canadians must have the right of access to a basic nutritious diet and a government food program.
18. Both domestic and international aspects of the food industry should be examined in this context.

19. There was a strong view advanced that the concept of government controlled minimum and maximum prices in the PDR sector is unacceptable.

Future Consultative Process

1. There was a consensus that there should be on-going consultation between all sectors of the food system. However, there was no agreement on how this should be done.

2. There should be regional and national food councils.

3. Government could take the lead by calling specific meetings on specific subjects.

4. A separate agency responsible to a specific minister could be established for coordination of consultations.

5. Annual conferences similar to this one with a steering committee to coordinate and follow up.

6. An interdepartmental committee to consult with the private sector should be established.

WORKSHOP ON CONSUMER CONCERNS

Chairman – Dr. G.A. Hiscocks, Secretary – Mr. B.H. Davey, Recorder – Dr. C.M. Williams

Consumer Information

There is general agreement that more and accurate information on prices, price changes and the reasons for price changes are desirable; however, there are qualifications that determine how this should be carried out.

1. Information which receives wide dissemination must be simple, understandable, creditable and demonstrably used by a significant number of the consumers in making purchasing decisions.

2. There is need by a small but important portion of the consumer group and other organizations and institutes for information on monitored prices gathered by an impartial organization with consultation at all levels of transaction in the food system.

3. The types of analysis carried out and the summary items they yield should serve as guidance to the consumer on low cost and nutritional purchasing.

4. Although there is merit in conducting detailed comparative market analyses, their greatest cost/benefit is on a special case basis and illustrates overall pricing than as an aid on continuing individual consumer marketing decisions. Examples would be where major price fluctuations in fruit occur in response to a crop failure or where a regional pricing differential occurs in overall food prices.

Structure, Organization and Membership of Market Supervisory Agencies

There is a great deal of misunderstanding among the representatives from the various sections of the food system as to the differences between marketing agencies, products or commodity pricing agencies and the National Farm Products Marketing Council. As a result, a consensus did not evolve.

1. Some feel that consumer representation is desirable on all levels of marketing organizations which operate under the umbrella of legislation.

2. There is a general support for consumer representation at those levels which have regulatory or supervisor responsibilities rather than on commodity boards with responsibility for product allocation and price negotiation.

3. There is concern that consumer representatives should be individuals who have the opportunity to become knowledgeable or have specialized training.

4. It is suggested that when the term consumer is extended to include retailers, food processors or the food service industry, there is great value in their association with the marketing organizations if only on specialized occasions, so supply and demand can be rationalized.

5. More information on the function and organization of marketing organizations should be provided to the public through the media.

6. Some opinion was expressed that some supervisory bodies do not exercise the full extent of the regulations which apply to commodity marketing boards.

Processing, Distribution and Retailing

The concerns in this area are numerous and this in itself seems to arise because of the following:

1. The PDR sector is a very complex sector of the food system which by design or lack of a suitable vehicle does not communicate its inner workings to the remainder of the system.

2. The rate of growth of the whole section has been so rapid that even those in the industry have difficulty comprehending all the implications.

The concerns break down into a number of areas:

1. Advertising and promotion of new products: the concern is that justification for some new introduction of products or practice is only for profit supported by advertising, not as is argued, because consumers demand the change. Packaging, junk foods and the universal products code are examples.

2. Competition: a closed marketing exchange does not encourage confidence in the overall competitiveness of its transactions. Concentration of corporate power through control by large multinationals and through integration both horizontal and vertical needs investigation.

3. Regulations: there are concerns that regulations desirable at their inception can become a problem. Examples would be limitations on advertising which inhibit providing useful nutritional information, and grading standards which reduce the efficiency of a production system. Reviews are necessary.

4. Advantages not be neglected: the PDR sector provides a wide range of choice which gives the consumer the ultimate method of control through purchase or rejection. Information is available on the prices and the pricing structure if consumers ask for it. There is also the choice between the individually owned food outlets, the large chains and the cooperatives so the consumer can ensure competition.

Consultations

The workshop agreed that continuing consultations between all parts of the food system were desirable but there was no consensus on the form these consultations should take.

While there was some limited support for the idea of a national food strategy consultative committee, many reservations were expressed about this type of institution for regular organized consultations. For example, it was argued that membership in such a committee would limit the ability of an individual group to offer its own advice to government.

A more informal consultative process was favored by many delegates and would involve representatives of all parts of the food chain. Consultations among the various parties on specific issues as they arose were favored by some.

National, regional and local workshops and conferences were mentioned as a means of exchanging information, sharing knowledge and increasing mutual understanding of the operation of the food system. One outcome could be the identification of problems or setting of objectives for each sector of the system.

There was concern that consultations with government can be hindered by frequent changes of ministers.

Pricing and Prices

A point stressed was that the food system must return to every sector a fair return on investment and price changes should be reflected uniformly when they occur. To extend this to pricing raises certain difficult questions such as the following:

1. What are reasonable prices and what are fair returns?

2. Is a price established competitively always desirable or does it need to reflect society's concern with the health of a sector as opposed to the strong competitive position of another?

3. How do average statistics and therefore prices apply to the low income earner? Whose responsibility is it to rationalize this problem?

4. Do price changes reflect supply changes for all the key products?

5. Are price increases in certain products of prime importance to the consumer?

As partial answers to these questions the following observations were made:

1. Acceptable or reasonable prices are those which will not result in a serious cut back in consumption.

2. Quality of product and a stable supply can be more important than modest increases in price.

3. Price increases which can be shown to be passed back to the producer are more acceptable.

4. Canada should strive for self-sufficiency in those food products for which we have a comparative advantage or marginal advantage; however, this must be a competitive, not an artificial, advantage created by undue protection or subsidization. Canada must retain its production base in agriculture for the multiplier effect it has on the total food system.

Nutrition and Food Safety

Although Canadian consumers have a wide selection of high quality foods to choose from, and supervised labelling and grades are substantial consumer protection, there continue to be some concerns:

1. Nutritional value is not emphasized equally with other standards on promotion.

2. Monitoring for residues may not be sufficient to cover the potential problem.

3. Standard grades or wholesome but ungraded materials are not generally available to consumers who would choose the bargain price over higher quality.

4. Consumer education concerning nutrition and food safety may be neglected by the food industry because it frightens consumers or competes with advertising copy. Expansion of nutritional education is required.

There are positive activities in the production sector which may mean fewer concerns for the future:

1. new plans for disease resistance, higher quality and greater yields;

2. new insect and disease controls without chemical treatment and

3. studies on climatology to improve yield and quality.

NOTES

Market Development

The following was taken from the March 3, 1978 issue of "News and Features", published by the Press Unit, Information Services, Agriculture Canada, Ottawa.

AGMAP is the Agricultural and Food Products Market Development Assistance Plan, a $1-million-a-year fund to help find or expand markets for Canadian agricultural products.

It is a joint program, run by Agriculture Canada and the Department of Industry, Trade and Commerce. ITC handles the projects that involve developing export markets. So far, 46 projects have been launched, with federal contributions of $5.6 million.

The government's contribution is usually 50 percent of the total cost of any project. Of course, funding varies with the type of project and the amount of risk involved. Normally, when the project results in a profitable sale, the government's contribution is repayable.

Wilf Parry, chief of the market incentives and opportunities section of Agriculture Canada's Food Production and Marketing Branch, says AGMAP's purpose is to assist the private sector in ventures which would otherwise not be undertaken or would be carried out on a reduced scale. The project must bring benefits to the primary producer.

Private firms and producer and industry associations are eligible for AGMAP assistance. Projects involving grains and oilseeds are excluded from this program, but receive assistance under another market incentive fund.

AGMAP funds helped sell Canadian breeding cattle to China in 1975. The exporter was reluctant to ship the cattle to China because there was some risk the deal would fall through after the cattle had arrived. AGMAP put up a $253,000 guarantee. Fortunately, the Chinese accepted the cattle, and the funds were not required.

More recently, funds from AGMAP are helping launch the SeCan Association. This is a non-profit industry association composed of pedigreed seed growers and the firms that clean and distribute seed. SeCan helps administer the multiplication and distribution of new seed varieties.

To help launch the new association, AGMAP has offered $310,000 over a five-year period, providing the association can match this amount with funds from its members.

Over the past few years, AGMAP has helped the Canada Sheep Council in its efforts to boost the production and sale of wool and lamb. It has helped the Canadian Horticultural Council to develop markets for Canadian apples and onions in the United Kingdom. A $252,880-contribution has helped the Quebec Cider Association seek new markets.

Canada and the World Food Program — Some Highlights

The objective of the World Food Program (WFP) is to get food to those who need it most. Aid is given directly in the form of school lunches, proper hospital diets, emergency relief and as part of the wages for local workers on development projects.

Gerry Vogel, a Canadian, has been appointed by the UN and FAO as the executive director of the WFP.

The WFP's target budget is $950 million. For 1979 and 1980, Canada, one of the founding members, has pledged $190 million — $170 million in commodities and $20 million in cash. For the 1977-78 fiscal year, in addition to the main pledge of 400,000 tonnes of grain and $13 million in non-grain food, Canada made a supplementary pledge of $4.5 million in skim milk powder and $1.5 million in cash. Canada gave another $7.5 million to the International Emergency Food Reserve. For the 1976-77 fiscal year, Canada pledged 400,000 tonnes of grains and $13 million in non-grain food plus supplementary pledges of $3 million in skim milk powder and $500,000 to cover transportation costs.

Since the WFP started in 1963 Canada has given approximately $475 million to the program.

For the WFP to be most successful, Canada stresses that programs should be action-oriented on a project basis, that food gets to people who need it, that food aid does not discourage food production in the country to which it is directed and that the government of the country receiving food aid is involved through its partnership in

projects using food aid, that the most needy and the least developed countries should receive the highest priority in food aid allocation, that losses and waste in the handling of food aid be minimized and that there be a continuous accounting and evaluation of food aid projects.

Canada's Response to World Poverty

Dr. D. Ware, associate director of Agriculture Canada's International Liaison Service wrote this note for CFE (Source: CIDA Annual Review 1976-77).

Canada has one of the world's larger programs of international cooperation, with approximately 2,000 projects designed to meet some of the priority needs of more than 80 developing countries. In 1976-77, the Canadian International Development Agency (CIDA) spend $963 million on overseas aid. The authorized level for 1977-78 is $1.1 billion.

About half ($478 million) of the 1976-77 expenditures were disbursed on bilateral (country-to-country) programs such as economic, food, technical and emergency assistance to developing countries in Asia, Commonwealth and Franchophone Africa, Latin America and the Caribbean. About 155 development projects were being carried out in the fields of agriculture, forestry and fisheries with another 150 in the planning stage. Other important sectors included health, water supply, education, energy, transportation, communications, resource development and land use. Canada also had about 1,600 Canadian advisers and educators serving overseas.

Another major portion ($417 million) of CIDA's 1976-77 budget was used for multilateral assistance, aid to international agencies such as the World Bank, regional development banks, United Nations' agencies, Commonwealth and Francophone programs and food aid channelled through the World Food Program. Funds are pooled with those of other countries to support development work in all parts of the Third World.

CIDA also spent $69 million on special programs. For example, Canada's non-governmental organizations received matching grants to carry out their people-to-people development efforts, the International Development Research Centre continued to fund research on specific Third World problems and scholarships were made available for Canadians starting a career in international development.

While CIDA's strategy is to combine steadily rising levels of assistance to the poorest of the developing countries, progress will be governed by the limited capacity of these countries to absorb development assistance.

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CANADIAN FARM ECONOMICS

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THE ECONOMICS OF INCREASING CROP PRODUCTIVITY IN ONTARIO AND QUEBEC BY TILE DRAINAGE INSTALLATION

H.T.M. Colwell*

There is a large proportion of the existing arable land in Ontario and Quebec which could benefit from tile drainage systems. Evidence suggests that improved drainage could increase yields of grain corn, soybeans, wheat, oats and hay from 25 to 50 percent.

INTRODUCTION

This article has three purposes – to review the status of tile drainage in Ontario and Quebec, to identify the cost and return changes which may occur when a farmer installs tile drainage and to assess the economic feasibility of increasing the productivity of five major crops in Ontario and Quebec by investing in a tile drainage system.

TILE DRAINAGE PROGRESS IN ONTARIO AND QUEBEC

During the last 15 years a high proportion of subsurface drainage was installed in Ontario and Quebec (Table 1). Substantially more drainage was installed in Ontario than in Quebec because of the large quantities of flat heavy soils in southwestern Ontario which could not support intensive arable farming systems without artificial drainage.

In 1970 slightly less than 3 million hectares of commercial farmland, representing more than 46 percent of the arable land in Eastern Canada, were estimated to require drainage improvement (Figure 1). In 1970 it was estimated that 60 percent of the improved farmland in Quebec and more than 40 percent in Ontario could benefit from improved drainage (Broughton 1976). The

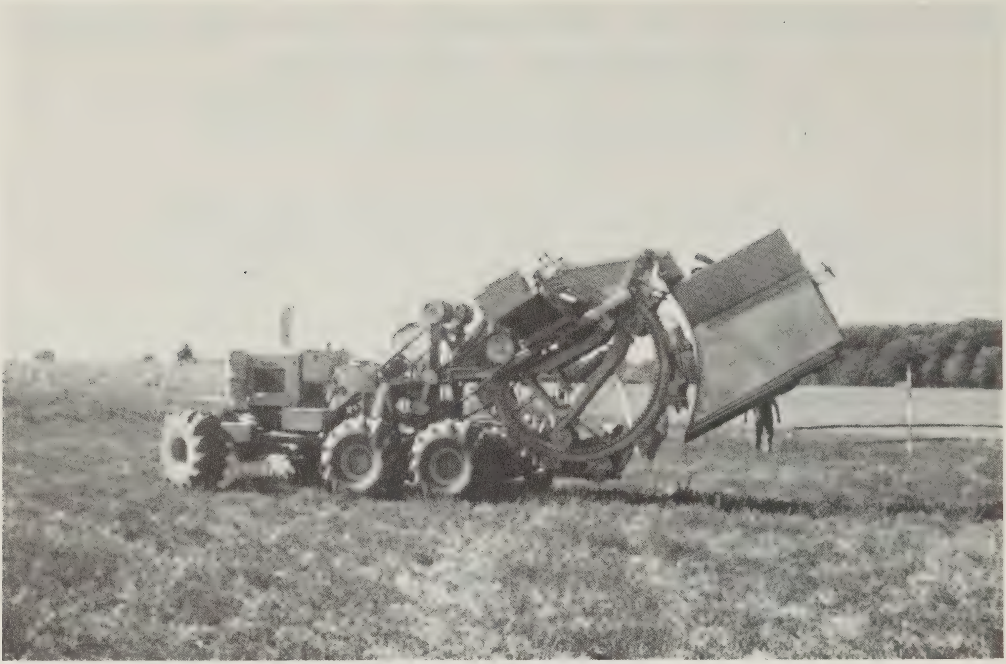
TABLE 1. APPROXIMATE EXTENT OF SUBSURFACE DRAINS INSTALLED IN ONTARIO AND QUEBEC

	Ontario[a]		Quebec	
Year	Length	Area	Length	Area
	km	ha	km	ha
Before 1964	429,141	809,700	2,233	10,496
1964	15,240	28,328	860	2,056
1965	15,850	30,351	1,042	1,962
1966	16,764	31,566	1,562	2,794
1967	17,678	33,589	1,889	3,503
1968	19,507	36,826	2,718	4,838
1969	19,202	36,580	3,448	5,875
1970	19,812	37,742	4,674	7,791
1971	19,812	37,742	6,556	11,174
1972	19,812	37,742	7,467	13,718
1973	19,812	37,742	11,582	21,974
Total	612,630	1,157,908	44,031	86,182

[a]Acreages based on 0.525 km of subsurface drains per ha.

Source: Adapted from Broughton (1976).

*Max Colwell is a research economist at the Agriculture Canada Research Station, Harrow, Ontario.



Equipment used in laying tile drainage.

largest areas requiring drainage improvement are in Ontario and Quebec and were estimated to exceed 2.8 million hectares. Although installation rates have increased since 1970, substantially more land must be tiled to provide satisfactory soil drainage for high crop productivity. Broughton (1975) estimated that if recent installation rates continued, it would take 41 years in Ontario and 50 years in Quebec to provide the drainage needed.

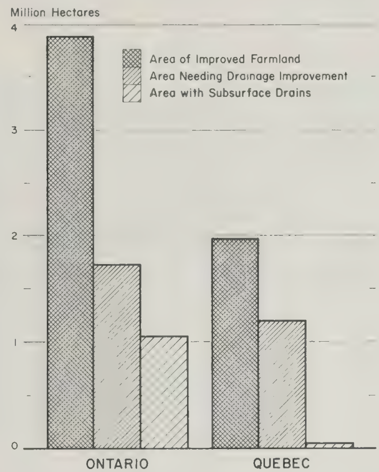
IDENTIFICATION OF COSTS AND RETURN CHANGES RELATED TO TILE DRAINAGE INVESTMENT

Increased food production will only be economically beneficial to the farmer if the marginal cost increases are lower than the marginal income increases occurring directly because of the tile drainage investment.

Subsurface tile drainage installation will provide a drainage system which should function efficiently for a long time, e.g., 40 years. The major capital outlay is for the initial drain material and installation. This initial outlay will result in annual interest and capital repayment charges which may be influenced by government programs that lower the drainage cost or provide loans at preferential interest rates. The full amount of tile drainage costs are deductible for income tax purposes in the year paid and hence, could result in substantial tax savings in a given year. Machinery costs may also decrease where improved drainage enables soil conditioning to be achieved in fewer, more timely operations.

The major benefit from improved drainage will be increased crop yields which can occur for two reasons. First, improved drainage leads to better plant growth from the available nutrients, resulting in higher yields and lower year to year yield variability. Second, yield increases can occur because good drainage permits earlier seeding and more timely harvesting. For example, biological research indicates that earlier planting increases yields of corn (Nolte), barley and oats (Nass, *et al.*). Although improved drainage may increase crop yields where the same seed, fertilizer and spray costs are incurred, production costs can increase because of the need to dry, store and transport the extra yield. Good drainage can maintain crop quality by enabling stronger plant growth which may result in lower disease levels, and by avoiding the need to harvest crops when soil conditions are unsatisfactory.

ESTIMATES OF IMPROVED AREA OF COMMERCIAL FARMS, AREA NEEDING DRAINAGE IMPROVEMENT AND AREA WITH SUBSURFACE DRAINAGE AS OF 1970*



* Adapted from Broughton (1975 and 1976)

Figure 1

Finally, increased land productivity is possible because good drainage permits a wider range of crops to be grown. In Quebec this might result in cereals being grown on land formerly used for forage, while in southern Ontario it may result in a change from small grains to grain corn, soybeans or processing vegetables. In such situations the increased crop returns from higher value crops must be balanced against the higher level of input costs (e.g., fertilizer, seed and sprays) and management skills which are usually necessary for the successful production of these crops.

TABLE 2. EFFECT OF DRAINAGE ON YIELDS OF FIVE CROPS[a]

Crop	Average Yield Before Drainage Improvement	Average Yield After Drainage Improvement	Yield Increase	
	t per ha	t per ha	t per ha	%
Grain corn	4.14	5.58	1.44	34.8
Soybeans	1.96	2.59	0.63	32.1
Wheat	1.77	2.61	0.84	47.5
Oats	1.60	2.35	0.75	46.9
Hay	4.10	5.20	1.10	26.8

[a]One tonne is equal to 37 bushels of wheat or soybeans, 39 bushels of grain corn or 65 bushels of oats.

There could be other benefits for the farmer who improves soil drainage. The market value of drained land is usually higher than that of undrained and the effects of inflation could also influence tile drainage investment returns. Where the tile drainage investment is financed with capital borrowed at fixed interest rates, the farmers may be making future interest and capital repayments with money which has a lower purchasing power than at the time of borrowing.

THE ECONOMICS OF INCREASING CROP PRODUCTIVITY BY TILE DRAINAGE INSTALLATION

Method, Data and Assumptions

A computer model, based upon capital budgeting theory, has been used to calculate the effects of the occurrence and timing of the costs and returns identified in the preceding section (Colwell). A detailed model description is not necessary foı the interpretation of results since the relevant data and assumptions are outlined here and in the appendix.[1]

This study assessed productivity increases due to crop yield improvement where the same cropping program is used before and after tile drainage installation. Due to space limitations, the effect of changing the crop mix to include high value crops is not presented here.

Data examining yield response to improved drainage are available for five crops – grain corn, soybeans, wheat, oats and hay – that are grown on approximately 55 percent of the improved crop land in Ontario and Quebec. The data, which have been compiled from published (Irwin) and unpublished data, represent results of individual years for a range of soil types, weather and drainage conditions (Table 2). The majority of the data were gathered in Ontario, reflecting the historical emphasis on drainage in that province.

Average yield increases due to drainage were 1.44, 0.63, 0.84, 0.75 and 1.1 tonnes per hectare for grain corn, soybeans, wheat, oats and hay. Drainage can be expected to increase crop yields of hay 25 percent, small grains 40 to 50 percent and grain corn and soybeans approximately 30 percent. Because of wide variations in soil type, however, yield responses to drainage on individual farms will vary. In this study, the response data have been used to indicate the potential drainage returns for Ontario and Quebec.

[1]Copies of the detailed description (Colwell) are available from the author.

Installing tile drainage.

Full details of other assumptions are in the appendix. Average crop prices for the 1975 and 1976 crop years were used and extra costs were included for drying, storing and transporting the extra yield; however, it is assumed that seed, fertilizer and spray application rates do not change after drainage installation. Tile drainage material and installation costs were $600 per hectare for grain corn and soybeans and $450 for the small grains and hay. These were based on extension recommendations for these crops (Irwin and Clayton) and 1977 cost levels in southern Ontario. All capital is supplied by the farmer who is assumed to have a taxable income of $7,000 which is representative of recent values for Ontario and Quebec (Gellner and Birks).

Results

The returns on capital investment are measured as internal rates of return.[2] For ease of understanding, these values should be interpreted as the highest after tax interest rate or opportunity cost which the farmer could afford to pay for capital. For example, the internal rate of return for drained land producing grain corn is 15.1 percent. This means that if the farmer can borrow capital at net of tax interest rates lower than 15.1 percent a year, the drainage investment will be profitable over the long term.

Table 3 contains summaries of the investment returns calculated for the crop yield increases reported in Table 2. Investment returns from draining land to be used for

TABLE 3. ECONOMIC RETURNS DUE TO DRAINAGE IMPROVEMENT FOR FIVE CROPS

Crop	Internal Rate of Return
	%
Grain corn	15.1
Soybeans	16.9
Wheat	17.7
Oats	11.5
Hay	8.2

[2] The internal rate of return is defined as the annual net of tax return on the outstanding capital. Hopkin *et al.* define it as that rate of return which equates the net present value of the cash-flow stream to zero.

grain corn, soybeans and wheat exceed 15 percent, substantially higher than returns from land used for growing oats and hay. Thus a farmer with limited capital available for drainage should place a higher priority on improving drainage on land currently used for growing grain corn, soybeans or wheat even though some of these crops require drains with closer spacings and higher initial costs.

The returns calculated for grain corn, soybeans and wheat substantially exceed recent and current interest rates of the major commercial lenders, i.e., chartered banks. Thus if the assumed cost-return relationships do not change significantly it would be profitable to finance drainage for these three crops through commercial sources. Drainage improvement for land which a farmer intends to maintain in oats or hay would be a marginal investment if capital borrowed at commercial interest rates were the prime source. There are government programs, however, in both Ontario and Quebec which influence the farmer's investment return. In Ontario, for example, loan capital is currently available at interest rates of 6 percent a year under the Tile Drainage Act. In such a situation draining land for hay production could be a good investment for a farmer.

Sensitivity Analysis

The results in the preceding section were calculated by using estimates of crop yield increases, crop prices and drainage costs. Since these factors vary for individual producers, this sensitivity analysis examines the effect of each on tile drainage investment returns.

Crop Yields

Improved drainage does not guarantee increased crop yields. However, with good management and production practices (such as using superior plant varieties, following recommended seed and fertilizer rates, early planting and timely soil conditioning) it provides a potential for increased yields. To evaluate the effect of lower yield responses on investment returns, yield increases equal to two thirds of the experimental results were assumed.

A reduced yield response has a major effect on the economic success of drainage investments. For example, the investment returns were reduced to 4.8 percent for hay and 6.9 percent for oats, well below the cost of capital borrowed from commercial lenders. The returns for grain corn, soybeans and wheat, which all exceed 9 percent, with wheat having an internal rate of return of 11 percent (Table 4), are in line with commercial interest rates. The higher returns for wheat are due partly to the lower drainage cost required (because extension recommendations indicate that wider drain spacings provide satisfactory drainage for wheat).

TABLE 4. THE EFFECT OF YIELD RESPONSE AND CROP PRICE VARIATION ON ECONOMIC RETURNS

Crop	Internal Rates of Return				
	Low Yield Response	Low Crop Prices		High Crop Prices	
	%	%	$ per t	%	$ per t
Grain corn	9.0	15.1	(92.88)[a]	18.4	(110.0)
Soybeans	10.1	14.0	(180.00)	20.1	(250.0)
Wheat	11.1	17.1	(120.00)	21.8	(150.0)
Oats	6.9	10.8	(90.25)	13.6	(110.0)
Hay	4.8	4.3	(30.00)	12.5	(65.0)

[a]Values in parentheses are the assumed crop prices.

The investment returns in Table 4 are based on the recommended tile drain spacings for individual crops. In practice, however, rotational cropping usually occurs; therefore the farmer must choose a tile spacing for the complete rotation, which may present difficulties where crops with different spacing recommendations are grown. Staff at the Harrow Research Station are identifying the effect of different tile drain spacing on yields of grain corn, soybeans and winter wheat, since these form a common rotation in southern Ontario. This information will then be used to identify the most economic drain spacing for this cash crop rotation.

This analysis of the effect of crop yield increases highlights the need for a combination of crops and production practices which effectively achieve the potential provided by improved drainage. Both factors are under the farmer's control and indicate the importance of high quality management performance.

Crop Prices

Average crop prices for the 1975 and 1976 crop years were used in the initial calculations in Table 3. These prices were substantially higher than those in the 1960s, but lower than those in 1973 and 1974. Crop price levels during the operational period of the drainage system are difficult to predict, as they depend on supply and demand factors both in Canadian and world markets. Crop prices received by farmers, however, can fluctuate during the lifetime of the tile drainage system.

To evaluate the potential effect of price changes upon returns from tile drainage investments, lower and upper price levels were established for each crop (Table 4). The

upper prices assumed for grain corn, soybeans, wheat and oats exceed prices for the 1977 crop year but are lower than the highest average prices received during the 1973 and 1974 crop years. The lower price levels are, for all crops except hay, the support levels set by the Agricultural Stabilization Act (ASA) 1975 and the Two Price Wheat Act 1974-1975. The wide price range ($30 to $65 per tonne) for hay reflects the lack of government support levels to counteract the low prices for this crop, the wide variability of hay quality and the availability of special markets, e.g., sales to horse owners, in some areas.

The results of price effects are included in Table 4. The returns for grain corn, wheat and oats using the lower crop price values are within 1 percent of those obtained when average prices for the 1975 and 1976 crop years were used. This reflects the fact that the "low crop prices" based on the support level prices for grain corn, winter wheat and oats are close to 1975 and 1976 producer prices. ASA calculations are partly based on crop prices during the previous five years. Because of market volatility, future ASA prices are difficult to predict. To illustrate the sensitivity of investment returns to future crop prices, the minimum prices necessary to obtain a 10-percent internal rate of return were calculated. These are $68 per tonne for grain corn, $135 for soybeans, $76 for winter wheat, $81 for oats and $55 for hay. The effect of a low yield increase on rates of return is greater than the effect of a low crop price in line with current ASA support level prices. This again emphasizes the need for good crop production management to exploit the crop production potential provided by better drainage.

High crop prices give investment returns in excess of current commercial interest rates for all crops and generally increase the investment returns 3 to 4 percent. To obtain internal rates of return in excess of prevailing interest rates when improving drainage on land to be used for producing hay, it is necessary to obtain both premium yields and crop prices.

Drainage Costs

The cost of drainage material is influenced by the choice of drain spacing, which reflects the soil type, crop mix, seasonal rainfall and by the transportation costs from the manufacturing point to the drainage site. The installation cost will depend on the soil conditions and the local availability of high capacity drainage machines. In addition, government assistance with installation and installation costs is available to farmers in Quebec, thus reducing the total drainage cost for farmers who take advantage of this. The total drainage cost will also be influenced by the need to improve drain outlets or main drains.

Because of the substantial cost variation which might occur between different drainage schemes used to grow similar crops, this sensitivity analysis identifies maximum drainage costs per hectare for the five crops under consideration. The maximum cost must be related to the minimum level of return required by the farmer. For example, a farmer who is supplying all the required capital may be satisfied with a return of 5 percent a year, but one who is borrowing capital at a 10 percent a year interest rate might require a 15 percent annual investment return to convince him to install drainage.

The maximum drainage costs per hectare for the five crops which provide 6, 10 and 15 percent internal rates of return are in Table 5. Assuming commercial interest rates of 10 percent a year on borrowed capital, it can be seen that drainage costs of less than $800 a hectare are feasible for grain corn and soybeans, and less than $735 for wheat, $505 for oats and $383 for hay. As the investment return required by the farmer increases, the maximum drainage cost which can be paid decreases. For example, in situations where the required internal rate of return is 15 percent, farmers growing hay should not invest more than $276 a hectare, while those using land for grain corn and soybeans could invest up to $602 for grain corn and $669 for soybeans.

TABLE 5. DRAINAGE COSTS PER HECTARE TO PRODUCE THREE LEVELS OF INTERNAL RATE OF RETURN

	Internal Rate of Return (%)		
Crop	6	10	15
	— drain cost, $ per ha —		
Grain corn	1275	847	602
Soybeans	1432	950	669
Wheat	1101	735	523
Oats	746	505	360
Hay	562	383	276

CONCLUSIONS

The potential for increasing food production in Ontario and Quebec by improving drainage is substantial. There is a large proportion of the existing arable land which requires drainage improvement and evidence indicates that better drainage could increase yields of five of the major field crops from 25 to 50 percent.

The yield potential will be attained only if the economic rewards of tile drainage investment are attractive enough to convince farmers to invest the large amounts of capital required for satisfactory drainage. When evaluating economic aspects, it is necessary to consider financing, taxation, governmental programs and land value in addition to the changes in crop value per hectare.

Using cost and return assumptions representative of current and recent conditions in Canada, it was calculated that the average crop yield increases obtained from a wide range of experimental situations would be sufficient to make tile drainage investment a profitable proposition for grain corn, soybeans and wheat. This would also apply when a substantial proportion of the required capital must be borrowed at commercial interest rates. The profits from installing tile drainage on land to be used for hay will probably be marginal. Profitable investments based on hay production are most likely where there is good crop management and where high prices can be obtained.

The profitability of tile drainage investment is influenced markedly by the crop yields attained, crop prices and by the tile drainage cost. Thus successful investments are most likely where good management is practised. In such situations, drainage material and installation costs per hectare under $850 for grain corn and soybeans, $500 for oats and $375 for hay would produce economic benefits sufficient to make the investment profitable at commercial interest rates.

APPENDIX

Standard Conditions

1. Tile Drainage Material and Installation Costs

Corn and Soybeans:	$600 a hectare for a drainage system with 15-metre spacings between laterals and a material and installation cost of $1.00 a metre.
Small Grains and Forages:	$450 a hectare for a drainage system with 20-metre spacings between laterals and a material and installation cost of $1.00 a metre.

2. CROP PRICES

Crop	Price[a]
	$/tonne
Grain corn	92.88
Soybeans	213.42
Winter wheat	123.97
Oats	95.29
Hay	46.69

[a]Prices are 1975 and 1976 averages taken from *Agricultural Statistics for Ontario,* 1976.

3. The area to be drained is 20 hectares.
4. The farmer's marginal tax rate on a taxable income of $7,000 is 0.3024.

5. DRYING, STORAGE AND TRUCKING CHARGES

Crop	Price
	$/tonne
Grain corn	19
Soybeans	6
Winter wheat	6
Oats	6
Hay	3

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THE ENERGY DEMANDS OF AGRICULTURE

*I.F. Furniss**

This paper was originally presented to the 1978 Canadian Agricultural Outlook Conference in Ottawa. It reviews the current energy consumption situation in Canadian farming and evaluates some of the important developments taking place throughout the world to make more economical use of fossil energy and to find alternatives. The author concludes that fossil energy will remain an important input in Canadian farming for many years to come, and that significant progress is being made in improving efficiency in use and in developing alternatives. The pace of the change will be determined largely by relative prices, both among the various energy sources and between energy prices and farm product prices.

INTRODUCTION

The rapid escalation in world crude oil prices, initiated by the Organization of Petroleum Exporting Countries (OPEC)[1] in 1973, has had worldwide repercussions. World crude petroleum prices increased 37 percent from 1972 to 1973, 227 percent in 1974, 1.6 percent in 1975, 4.6 percent in 1976 and 11.5 percent in 1977.[2] The Canadian farm petroleum products' price index increased 6 percent from 1972 to 1973, 13.5 percent in 1974, 20 percent in 1975, 15 percent in 1976 and 9 percent in 1977 (Figure 1). Figure 1 also shows the impact which higher petroleum product prices have had on the total farm input price index and on the prices of fertilizers and pesticides, both of which are manufactured from petroleum products. While the year-to-year variation in fertilizer and pesticide prices are generally similar to those for petroleum, fertilizer prices varied more widely.

In Canada total farm costs (farm operating expenses plus depreciation allowances) and costs of fertilizers and pesticides, in terms of year-to-year changes, followed a pattern similar to the annual price changes of the energy-related farm input prices (Figure 2). Total farm expenses increased 7 percent a year in the 1964-68 period. The highest annual rates of increase subsequently reached to date were the 22-23 percent increases in 1973 and 1974. By 1977 the rate of increase in farm expenses was down to less than 7 percent. This rate will probably continue in 1978.

Fossil fuel consumption in Canadian agriculture continues to rise even in the face of sharply rising prices. There is at least one explanation for this. It is relative input prices which encourage resource substitution and relative product-input prices which encourage resource use in a market economy but usually with time lags. Thus while fuel prices increased 70 percent from 1973 to 1977, hired farm wage rates also went up 70 percent; machinery prices, however, increased only 57 percent. Also, the direct energy input in Canadian agriculture is a relatively small proportion of the value of the final product, about 6 percent in 1976.[3] In the same year these direct energy costs represented about 5.5 percent of total farm operating expenses or 4.5 percent of operating and depreciation expenses.[4]

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[1] Abu Dhabi, Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Quator, Saudi Arabia and Venezuela.

[2] United Nations, *Monthly Bulletin of Statistics*, Dec. 1977, Table 59. The figure for 1977 is the change between the third quarter of 1976 and the third quarter of 1977 indexes.

[3] Petroleum products and electricity as a percentage of farm cash receipts plus income in kind from farm products.

[4] Statistics Canada, *Farm Net Income*, Catalogue No. 21-202 Annual.

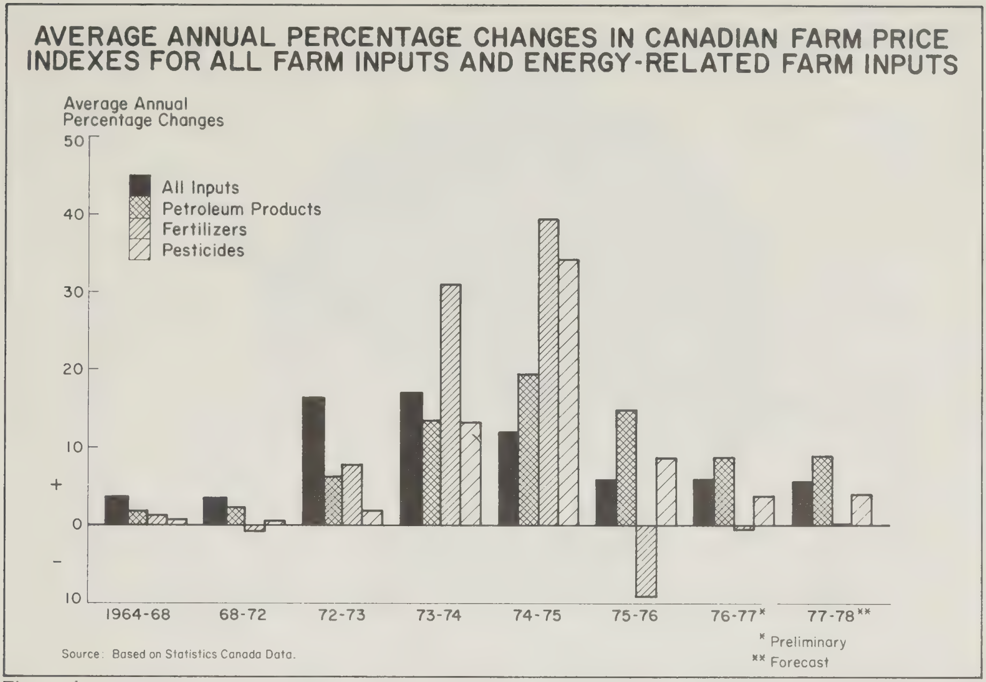


Figure 1

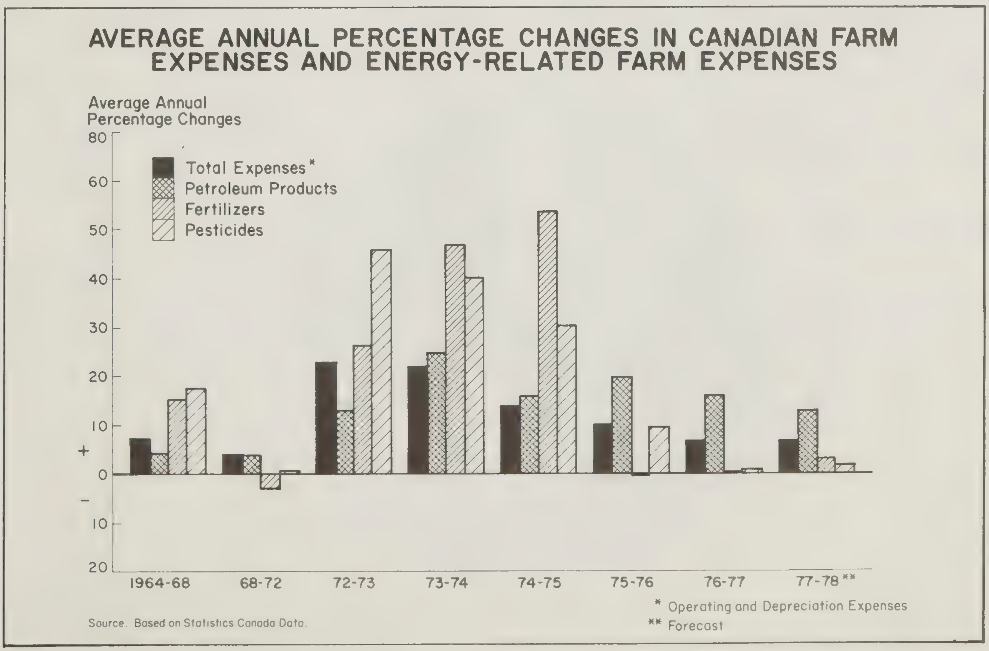


Figure 2

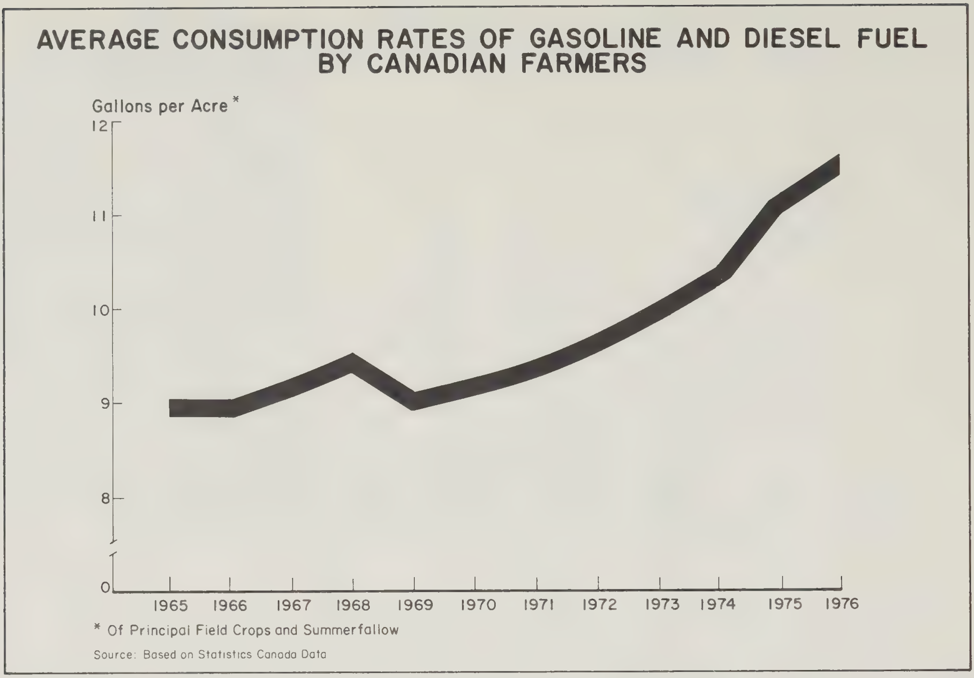


Figure 3

Total gasoline and diesel fuel consumption when related to the area in farming,[5] showed an average increase of about two gallons an acre between 1965 and 1976 (Figure 3). This increase can be attributed largely to the increased use of fossil-fueled equipment on farms in this period. (This will be discussed later.)

ENERGY USE IN FARMING

It was earlier indicated that direct energy use in Canadian agriculture (energy being defined narrowly as petroleum products and electricity) was relatively small, both in terms of percentage of total farm expenses and of total value of output. But the energy consumed in farming also includes that used in the manufacture of farm machinery, fertilizers (principally nitrogen fertilizers), pesticides and in the transportation of these inputs to farms. Figure 4 illustrates the distribution of both direct and indirect energy use in farming. Direct use (fuel and lubricants) makes up two-thirds of the total while indirect use (fertilizers, pesticides, machinery and transportation) accounts for the balance. Fertilizer is the second most important category of energy used in agriculture, taking 16 percent of the total. Generally, however, primary agriculture is a relatively small energy user, utilizing less than 3 percent in direct forms. It takes much more energy to process, distribute and prepare food products – at least 12 percent of all energy used in the Canadian economy.[6]

Certain crops which require large amounts of fertilizer, pesticides and cultural operations require a greater proportion of energy than the agricultural economy as a whole. Figure 5 shows the distribution of the energy requirements of grain corn. Because of the large fertilizer (principally nitrogen) requirements, indirect energy use in corn production is greater than direct use. But for every unit of energy input (direct and indirect) used, corn produces over three units of nutritional energy output.[7] Among the major Canadian-grown cereal

[5] Area of principal field crops plus summerfallow. In 1965 the total area of such was 91 million acres, and in both 1976 and 1977, 94 million acres.

[6] Agriculture Canada, *Energy and the Food System*, Dec. 1976, p. 47.

[7] P.H. Southwell and T.M. Rothwell, Unpublished Report on "(An) Analysis of Input/Output Energy Ratios of Food Production in Ontario," School of Engineering, University of Guelph, March 1977. Study funded by Agriculture Canada, Contract Number OSW76-00048.

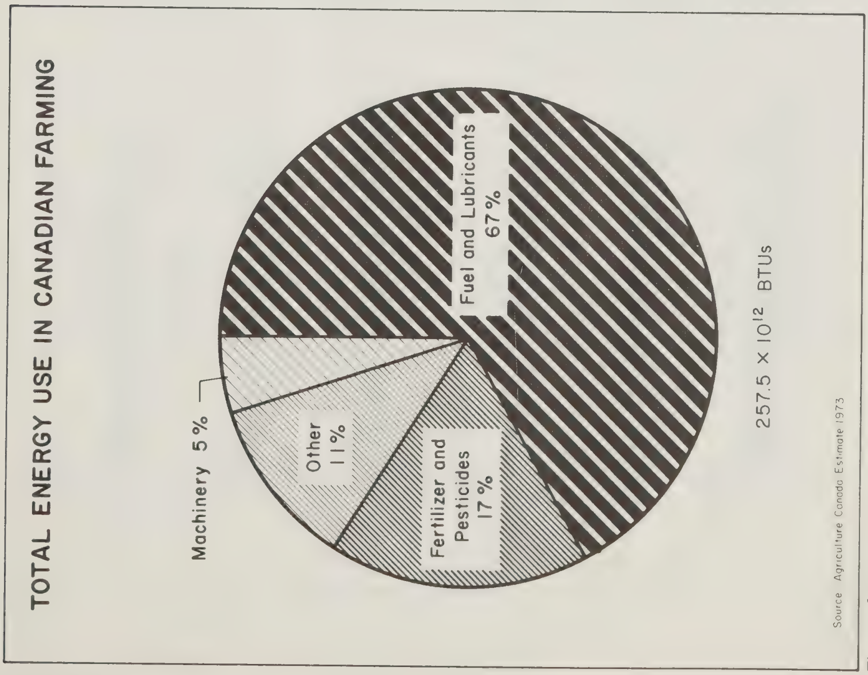


Figure 4

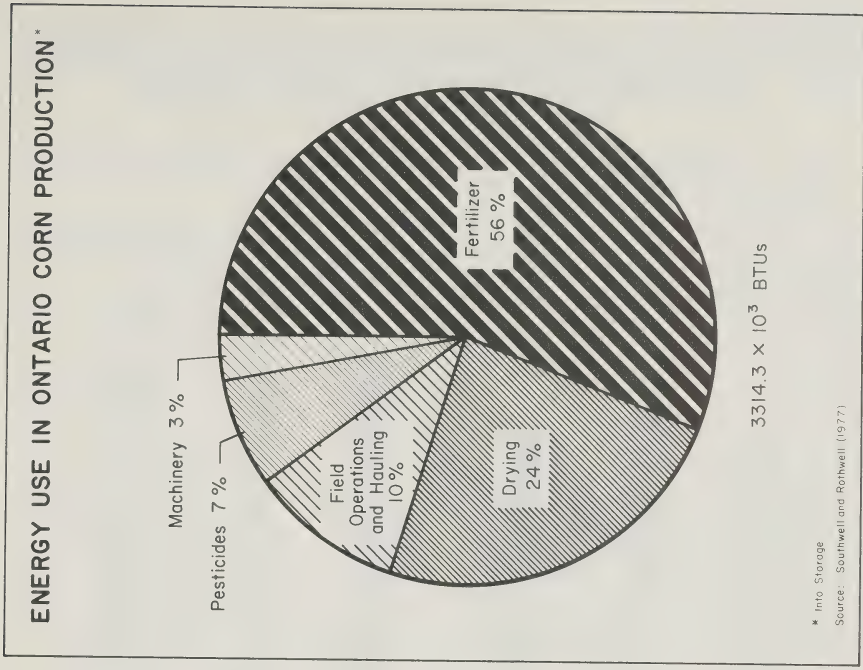


Figure 5

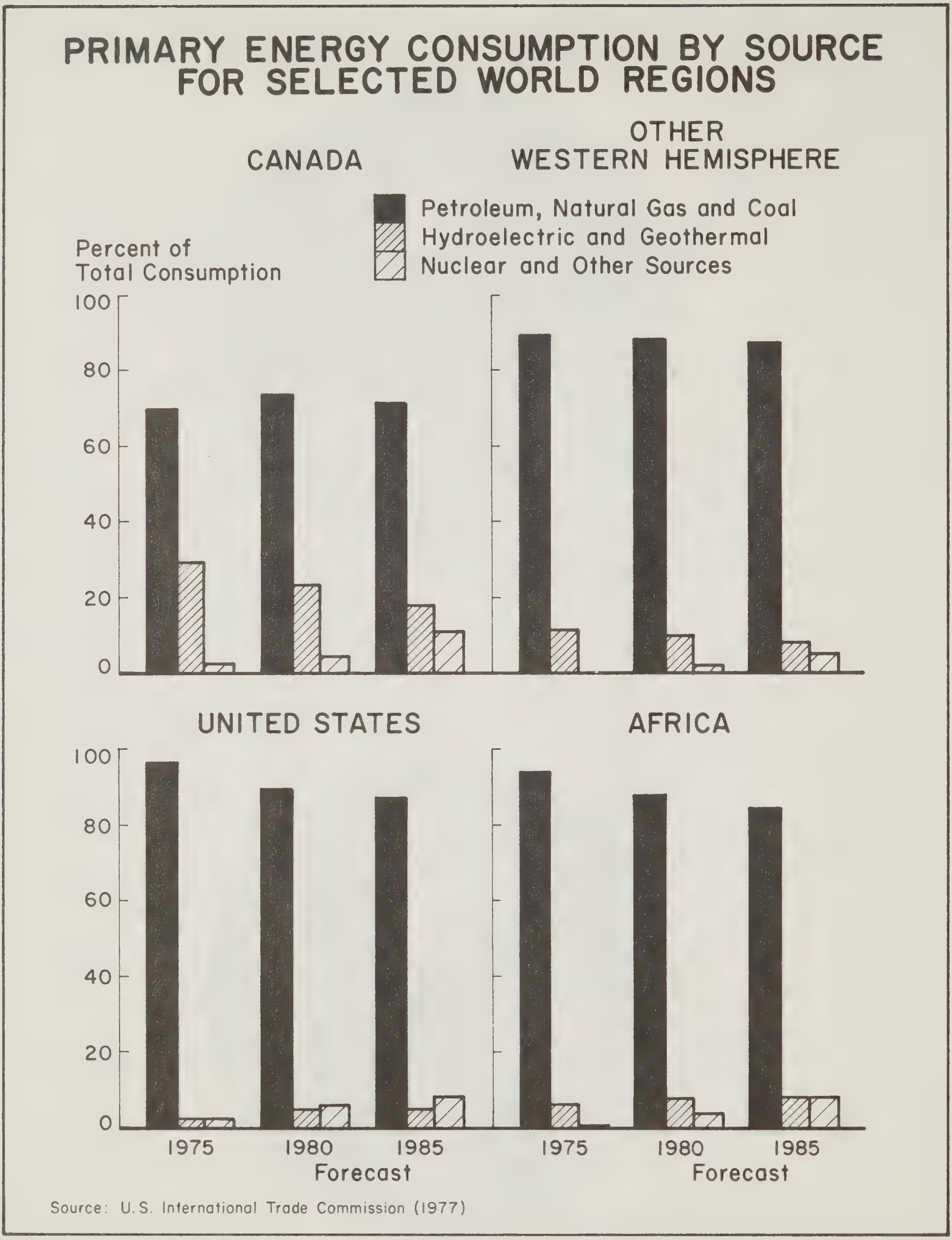

PRIMARY ENERGY CONSUMPTION BY SOURCE
FOR SELECTED WORLD REGIONS
CANADA
OTHER
WESTERN HEMISPHERE
Petroleum, Natural Gas and Coal
Hydroelectric and Geothermal
Nuclear and Other Sources
Percent of
Total Consumption
100
80
60
40
20
0
UNITED STATES
AFRICA
1975
1980
1985
Forecast
Source: U.S. International Trade Commission (1977)

Figure 6

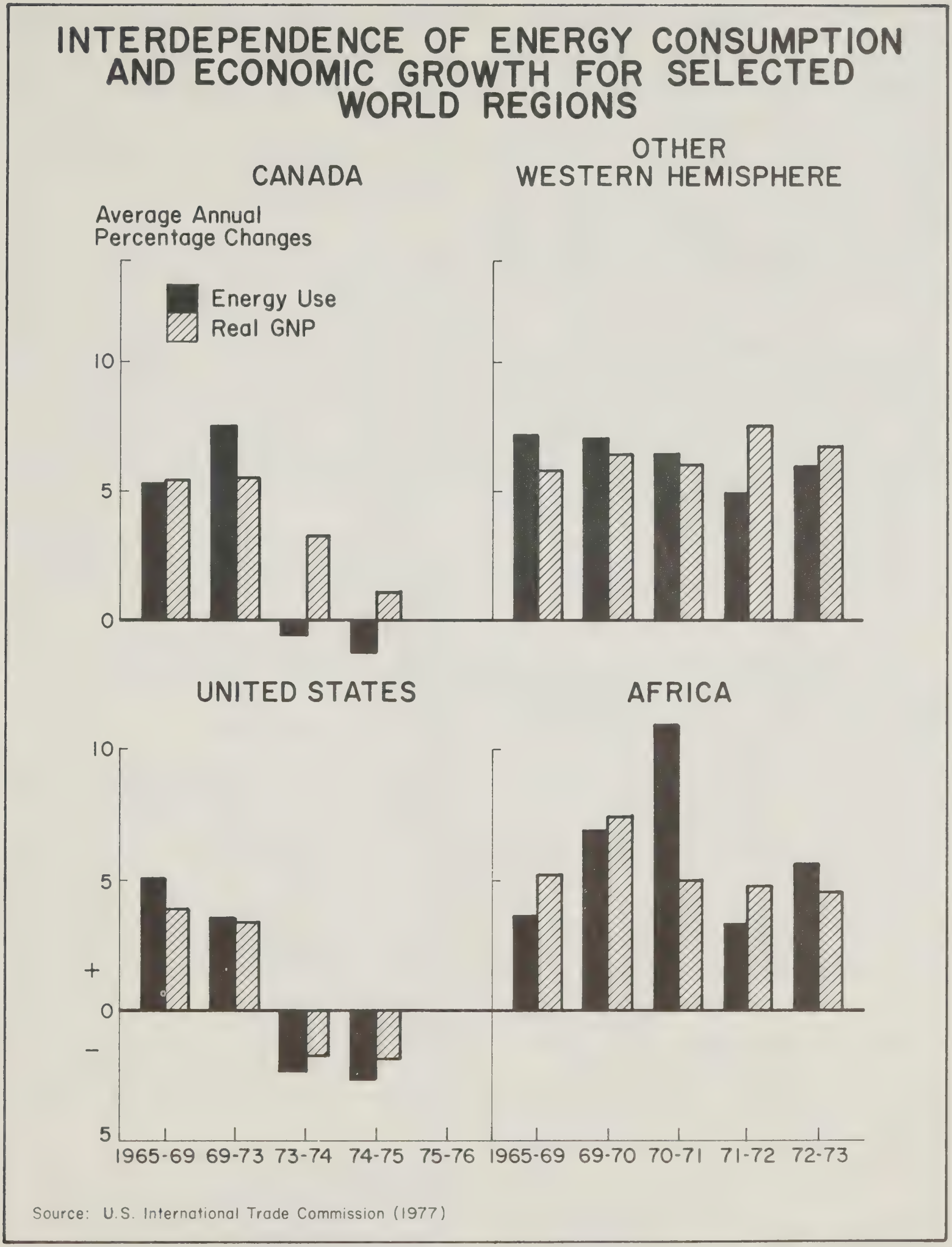

INTERDEPENDENCE OF ENERGY CONSUMPTION AND ECONOMIC GROWTH FOR SELECTED WORLD REGIONS
CANADA
OTHER WESTERN HEMISPHERE
Average Annual Percentage Changes
Energy Use
Real GNP
10
5
0
UNITED STATES
AFRICA
10
5
+
0
–
5
1965-69
69-73
73-74
74-75
75-76
1965-69
69-70
70-71
71-72
72-73
Source: U.S. International Trade Commission (1977)

Figure 7

crops, however, only rye is lower in efficiency than corn (2.4:1). The efficiency of other crops, such as winter wheat, oats, barley and especially soybeans, exceeds corn. The nutritional energy output from soybeans is more than five times the energy input. Soybeans, of course, are a legume and little additional nitrogen fertilizer is required. By contrast, the nutritional energy output of chicken broilers is only about 0.1 per unit of energy input. In meat production, swine have the highest ratio, 0.34:1 (i.e., one unit of energy input yields one-third of a unit of nutritional energy output), and for milk the ratio is 0.51:1, higher than that for eggs and for cheese.

Canada is heavily dependent on fossil energy, for both farming and non-farming. This dependence is expected to continue to 1985 and beyond.[8] Canada is not unique in this respect, as can be seen by the selected comparisons in Figure 6. With its hydroelectric power providing almost one-third of the country's total energy, however, Canada has a lower dependence on fossil energy sources than do other parts of the world. By 1985 hydroelectric sources are predicted to shrink to about one-fifth of their present level; most of the growth is expected in nuclear power, up from its present level of about 2 percent to over 10 percent.

Like most other countries, Canada has become heavily dependent on increased use of energy in all forms, especially fossil fuels, for economic growth (Figure 7).[9] When real (constant dollar) economic growth slows down, as it has done in Canada in recent years, total energy consumption decreases because of reduced demands for energy in manufacturing, producing raw materials and transporting finished goods. Economic recovery can be expected to increase the demand for energy. If the past is any guide, the increase in energy consumption will be greater than the growth in real Gross National Product in a given period. With rising energy prices, however, the rate of increase in demand should be dampened and result in improved efficiency in use.

PETROLEUM PRODUCTS

Although primary agriculture accounts for a small part of the total energy consumed in the country, it is an important consumer of motive fuels such as gasoline and diesel fuel. Consumption of these fuels in Canada is increasing more rapidly in the non-farm sector than in the farm sector (Figure 8). In 1965 farming used about 13 percent of the gasoline and 17 percent of the diesel fuel consumed in Canada. The most recent figures are 10 percent for gasoline and 13 percent for diesel fuel.[10] But even though agriculture is consuming proportionately less of the total fuel used in the country, fuel consumption in agriculture is increasing.

Table 1 shows the trend in gasoline and diesel fuel consumption in Canada since 1965 in the farm and non-farm sectors. In the non-farm sector, consumption increased from 4.9 billion gallons in 1965 to 9.3 billion gallons in 1976 and in the farm sector from 806 to 1,078 million gallons in the same period. The significant change for farming in this period is the much more rapid growth in consumption of diesel fuel than of gasoline. It is likely, therefore, that gasoline use in farming is now at or close to its peak, and that the future use of fossil fuels in Canadian farming will be dominated by diesel fuel.

A similar pattern is also evident in the United States. Farm consumption of gasoline averaged about 4 billion gallons a year until 1973, but has since approximated 3.7 billion gallons. Diesel fuel consumption, which was only 1.3 billion gallons in 1965, reached 1.9 billion in 1970 and has been increasing rapidly since. In 1976 consumption was almost 3 billion gallons.[11]

Alternatives to Fossil Fuels

A large proportion of the energy requirements for farming, especially for field operations, was once provided by the agricultural sector itself. In 1921 the number of horses and mules on farms in Canada reached a peak of almost 3.5 million.[12] It was not until 1954 that this figure dropped below one million. It took millions of acres to produce the forage and grain to feed these animals and all of this energy was produced in the farm sector. Thus the substitution of horses with fossil-fueled mechanical power contributed significantly to the increased market output of Canadian farms after World War II. The contribution to total output for market through this substitution of mechanical power for animal power was probably greater than the increase

[8] United States International Trade Commission, *Factors Affecting World Petroleum Prices to 1985*, USITC Pub. 832, Washington, D.C., Sept. 1977.

[9] See Footnote 8.

[10] Statistics Canada, *Refined Petroleum Products*, Catalogue No. 45-208 Annual.

[11] USDA, *1977 Handbook of Agricultural Charts*, Agriculture Handbook No. 524, Washington, D.C., Nov. 1977, p. 11. The figures given are in U.S. gallons.

[12] Statistics Canada, "Handbook of Agricultural Statistics, Part VI," *Livestock and Animal Products*, Catalogue No. 21-508 Occasional.

TABLE 1. NET SALES OF MOTOR GASOLINE AND DIESEL FUEL IN CANADA, 1965-76

Year[a]	Motor Gasoline				Diesel Fuel			
	Non-Farm		Farm		Non-Farm		Farm	
	mil. gal[b]	% change[c]	mil. gal	% change	mil. gal	% change	mil. gal	% change
1965	3,905	—	592	—	1,031	—	215	—
1966	4,164	6.6	601	1.5	1,142	10.8	218	1.4
1967	4,380	5.2	614	2.2	1,217	6.6	223	2.2
1968	4,705	7.4	641	4.4	1,281	5.3	232	4.4
1969	4,935	4.9	615	−4.0	1,380	7.7	215	−7.4
1970	5,221	5.8	642	4.3	1,476	7.0	200	−7.2
1971	5,422	3.9	647	0.7	1,573	6.6	213	6.6
1972	5,833	7.6	660	2.0	1,711	8.8	228	6.8
1973	6,346	8.8	684	3.6	1,945	13.7	248	9.1
1974	6,615	4.2	676	−1.2	2,155	10.8	270	8.9
1975	6,839	3.4	733	8.6	2,108	−2.2	304	12.4
1976	7,048	3.0	755	3.0	2,240	6.3	323	6.3

[a] The farm consumption figures for diesel fuel for 1965-67 are unofficial estimates, as are the 1976 farm consumption figures for both gasoline and diesel fuel.

[b] Imperial gallons.

[c] Percentage changes are year-to-year.

Source: Statistics Canada, *Refined Petroleum Products,* Catalogue No. 45-208 Annual.

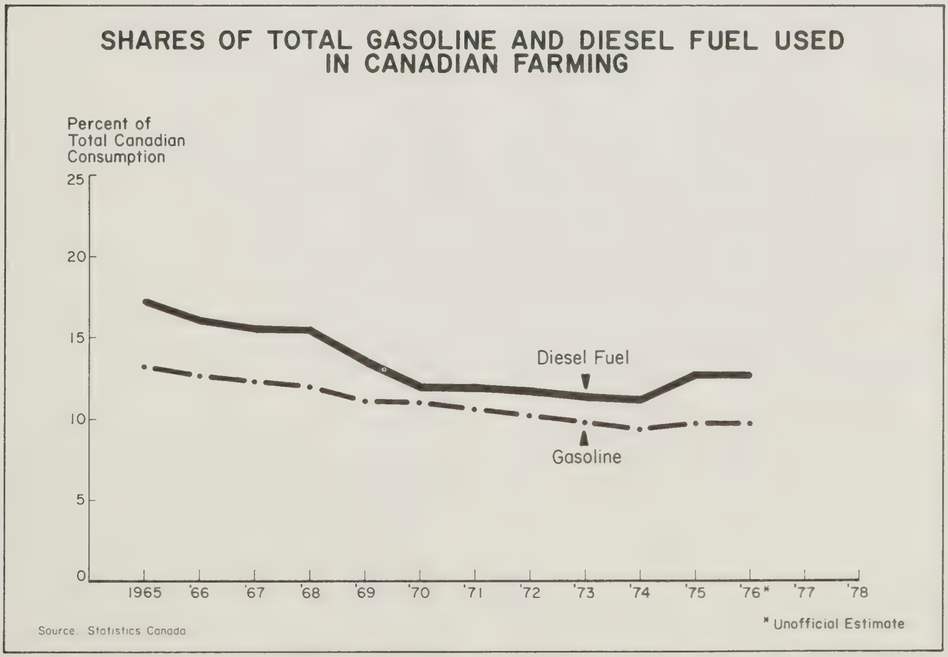


Figure 8

due to more improved acres on farms in the same period. Between 1947-51 and 1972-76, the gross farm output of Canadian farms increased 73 percent.[13] At the same time, the total area of improved land on farms increased at less than half this rate (32 percent), from 82 million acres in the earlier period to 108 million in the latter period.[14]

While agriculture for many years produced its own energy directly by converting crops to animal power, a return to animal power as a major source of field power is unlikely. Current research and development in many countries point to alternatives such as alcohol production from farm or forest products, coal and natural gas; conservation; and more efficient use of fossil fuels. Some selected examples follow.

Brazil

Brazil is heavily dependent on imported oil;[15] it's total primary energy demand is estimated to be doubling every 10 years. In 1975 Brazil began a long-range program to produce anhydrous alcohol from sugarcane and cassava (manioc) to be used principally as a gasoline stretcher. Production is expected to reach almost 900 million Imperial gallons of alcohol a year by the 1980s. This would supply 20 percent of Brazil's estimated fuel needs. About 2.2 million acres of Brazil's total cropland area of 111 million acres would be required to produce the volume of alcohol needed for a 1:5 alcohol-gasoline mixture.

Already approximately 175 million gallons of ethyl alcohol are being produced yearly, mainly from sugarcane. The technology for producing alcohol from sugarcane is well established. Alcohol is produced from cassava enzymatically. In 1977 the world's first cassava distillery plant began operation in Brazil. Cassava's big advantage is that it will grow almost anywhere in Brazil and is not seasonal.

The economic study of the project showed that alcohol can be produced at a cost competitive with the fixed price of gasoline, exclusive of taxes, in Brazil at the time of the study, or $1.50 (U.S.) a U.S. gallon. At the beginning of 1977, construction of 83 distillery projects had been approved, five of which will use cassava as the raw material. Most of the rest will use sugarcane.[16]

Brazil is more favorably located than many countries, certainly Canada, for growing crops to produce alcohol. Besides cassava and sugarcane, Brazil is the home of several other plants that can be used to produce hydrocarbons, including the rubber tree and the milkweed (or milk bush).[17] On an experimental basis, rubber growers in Malaysia have produced 4,000 pounds of leaves per acre a year. Some individual trees produce the equivalent of 8,000 pounds per acre annually, or four tons of hydrocarbons. Milkweeds in Brazil ordinarily reach heights of 8 to 10 feet. With some new species, new shoots arise when the thick stems are cut near ground level. And several species thrive in arid areas.

United States

Other countries are also developing methods aimed at producing alcohol from agricultural products. In the United States, for example, researchers at Purdue University reported an improved method for making alcohol from corn stalk residues.[18] An enzyme-organic solvent breaks down the cellulose material into sugars that can then be made into alcohol. While there is nothing new about making sugar from cellulose, the improved process yields a 100-percent return; a ton of cellulose yields a ton of fermentable sugar which is enough to make approximately 100 U.S. gallons of alcohol. Previous methods have recovered only about 50 percent of the potential sugar in cellulose.

According to the Purdue scientists, the advantage of using corn stalks rather than grain corn is that corn stalks provide a more stable raw material cost. And the U.S. Corn Belt normally has a large supply of corn stalk residues. Costs of producing alcohol under this process

[13] Statistics Canada, *Index of Farm Production*, Catalogue No. 21-203 Annual. The comparison is made using five-year averages of the annual indexes.

[14] Statistics Canada, *1976 Census of Canada: Agriculture*, Catalogue No. 96-854SA4, p. 1.

[15] This overview of developments in Brazil is based mostly on the following articles:

a. Edmond Missiaen, "Brazilian Agriculture to Help Meet Fuel Needs," *Foreign Agriculture*, USDA, May 2, 1977.
b. FAO, *Ceres*, Rome, March-April 1977.
c. Eric Jeffs, "Energy Profile of Brazil," *Energy International*, September 1976, pp. 21-23.

[16] The World Bank released a study in late 1977 stating that Brazil's alcohol production program was unfeasible in the short-term. The Brazilian Minister of Industry and Commerce agreed with the report but added that, starting in 1985, when oil shortages and higher prices prevail, the program should be feasible. By 1985 Brazil expects to be producing enough alcohol to substitute for all gasoline being used. The Minister emphasized that this program has always been considered as a long-term solution, not a short-term one as the World Bank was assuming.

[17] Melvin Calvin, "Gasoline Tree Plantation," *Agricultural Engineering*, Nov. 1977, pp. 12-16.

[18] *Wall Street Journal*, Oct. 27, 1977.

are roughly equivalent to those for producing synthetic alcohol from petroleum, i.e., 16 to 17 cents (U.S.) a pound of alcohol. The process is equally applicable to other crop residues.

In 1974 the Nebraska Agriculture Products Industrial Utilization Committee in co-operation with the Department of Chemical Engineering at the University of Nebraska, the Nebraska Department of Roads and the Cooperative Refiners Association began a two-million-mile test program to compare the performance and properties of unleaded gasoline and GASAHOL. The latter is a 10-percent-by-volume mixture of ethanol and gasoline. The ethanol is produced by fermentation, using grain corn and 75 percent of the field wastes. The results indicated that when both the farming operation and the fermentation process are considered and both grain and field waste are used, then for every three gallons of grain alcohol produced, at least one gallon is new energy entering the economy. At 1976 corn prices and an ethanol production cost of $1.10 (U.S.) a U.S. gallon, the project produced GASAHOL at a cost competitive with unleaded gasoline prices in Nebraska and a return on investment of 9.2 percent. The project leaders concluded that the production of industrial alcohol by the fermentation of corn and field wastes under the price and cost regime prevailing in 1976 was an attractive process both from an economic and energy standpoint.[19]

Canada

Research scientists at the Morden, Manitoba, Research Station of Agriculture Canada have been examining the Jerusalem artichoke as a possible source of alcohol.[20] This plant is a member of the sunflower family but, unlike the cultivated sunflower, it produces numerous underground tubers.

On an experimental basis, the Jerusalem artichoke has been a heavy yielder. On a commercial basis it is expected to match the yield of sugar beets. One of the plant's advantages is its high fructose sugar content. (Canada imports most of its fructose sugar requirements.) A second is that it is almost twice as productive as grain corn as a source of alcohol. Disadvantages include the fertilizer requirements (about equal to potatoes), problems with certain plant diseases and bacterial rot in stored tubers. And current harvesting methods are not gentle enough to prevent damage to thin-skinned tubers.

Conclusions

The foregoing cases are only examples of what is being done to find fuel substitutes from plants or plant residues. It was noted that alcohol prices were competitive with gasoline prices in Brazil, which are high by North American standards ($1.50 a U.S. gallon and about $1.80 an Imperial gallon). Gasoline prices in Canada and other western countries, however, are still much below this level. In April 1977, regular gasoline was selling in Ottawa, Canada for 52 cents an Imperial gallon (net of taxes which were 34 cents). Among a selected group of Northern Hemisphere, western capitals, the Canadian price was the lowest (net of taxes).[21] Stockholm, Sweden had the highest price at 85 cents an Imperial gallon (net of taxes). With an initial price of 52 cents a gallon, it will be 13 years before the price of gasoline in Canada reaches $1.80, assuming an annual growth rate of 10 percent in price. Meanwhile the cost of producing alcohol from agricultural sources with current technology will also be increasing, although perhaps at a lesser rate.

There are also experts who do not agree that agriculture can supply its own energy from crops and crop residue. Dr. Georg Borgstrom of the University of Michigan points out that while crop residues can be shown to have an energy potential, it takes a lot of energy to collect and process these residues.[22] In fact, if it is heat that is needed, then it would be more economical to burn the straw or corn stalks directly. Electricity could also be produced by burning wastes, but this would not fulfill motive fuel requirements. McClure and Scantland of the Battelle Columbus Laboratories in the United States concluded that the economic attractiveness of using agricultural crops to manufacture fuels will depend primarily on the future price of alternative fuel sources.[23] According to them, the manufacture of fuels from sugar crops does not appear likely between now and the year 2000. They also maintain that the most direct conversion of corn stover to fuel (electricity) does

[19] William A. Scheller and Brian J. Mohr, "Gasoline Does, Too, Mix With Alcohol," *Chemtech*, Oct. 1977, pp. 616-623.

[20] a. "Potential Energy Crop," *News and Features,* Agriculture Canada, Sept. 23, 1977.
b. "Jerusalem Artichoke Tubers Are Waiting to be Exploited," *Manitoba Co-operator,* Sept. 29, 1977.

[21] *Economic Council of Canada Bulletin,* Vol. 2, No. 1, Dec. 1977, Ottawa. Prices given are in Canadian dollars.

[22] Georg Borgstrom, "Energy: There's Not Enough," *Agricultural Engineering,* Sept. 1977, pp. 11-13.

[23] Thomas A. McClure and D. Alan Scantland, "Energy: New Crop Sources," *Agricultural Engineering,* Sept. 1977, pp. 17-20.

not appear economically viable until petroleum reaches U.S. $20 per barrel (1977 dollars) and if coal prices follow the same trend as oil prices.

It should not be overlooked that using crops to produce alcohol for fuel could reduce the acreage available to produce food and feed crops. If crop residues could be used in this way, however, the problem would not arise to the same extent. In Brazil it was estimated that substituting alcohol completely in the economy for gasoline by 1980 would require 16.3 million acres out of Brazil's total current cropped area of about 111 million acres, almost 15 percent of the area cropped.[24]

Hence for the foreseeable future, crops and crop residues, especially in northern climates, do not appear to be practical sources of motive fuels. But progress is being made in developing crop sources for fuels and improving efficiency in the use of fossil fuels. These developments are expected to continue and to accelerate. The pace of the change will be determined largely by the costs of alternatives. In northern climates these could be forest products, coal (which is relatively abundant) and natural gas. Use of these would not remove present lands from agricultural production.

FERTILIZERS

In any consideration of alternative energy sources, fertilizer use in agriculture has to be considered. Fertilizers account for over 15 percent of total energy consumption in farming and for some crops, such as corn, for over one-half of the total energy input. It takes about 35,000 cubic feet of natural gas to produce about 1,600 pounds of nitrogen and corn is a heavy user of nitrogen fertilizer. (The energy demands for the manufacture of phosphatic and potassic fertilizers compared with nitrogeneous fertilizers are relatively small.) Also, transportation costs represent almost one-third of the final price of fertilizers. While fertilizers are a small part of the volume of all goods transported, any reduction in the transportation cost component of fertilizers will contribute to a reduction in national transportation energy requirements. All forms of transportation represent about one-quarter of total energy consumption in Canada and road transport energy needs account for approximately 80 percent of total transportation energy requirements.[25]

The trend since 1964-65 in total fertilizer consumption in Canada for the three primary nutrients is shown in Figure 9. The increase in annual compound growth of nitrogen consumption has been the most rapid, over 10 percent. The growth rates for phosphates and potash have been approximately 5 percent a year, with phosphate consumption increasing slightly faster than potash. As the figure indicates, however, the growth in total consumption has been levelling off so that by 1980-81 it might be about 1.8 million tons for the three primary nutrients, or about 20 percent more than in 1976-77.[26] What this suggests is that the growth rate in fertilizer consumption in Canada between now and the 1980s will be modest unless there is a return to the highly favorable grain-fertilizer price ratio experienced in the 1972-73 and 1973-74 fertilizer years.

While the developed countries still account for about 50 percent of world production and consumption of the three primary fertilizer nutrients, production and consumption have been expanding rapidly in the developing and centrally-planned economies (Figure 10).[27] Even though fertilizer consumption in Canada appears to be levelling off, faster growth in demand in other parts of the world can affect both supply and prices for Canadian farmers.

There are several alternatives to the present level of use or increased use of fertilizers that can result in reduced requirements for fossil energy in Canadian agriculture. Since about 30 percent of the final price of fertilizers is for transportation, any development that reduces the inert material component of fertilizers will reduce the transportation cost component. The average nutrient content (N, P_2O_5 and K_2O) of fertilizers sold in Canada currently averages approximately 47 percent. In 1961 the proportion was 33 percent. Since then, fertilizers sold in Canada have become more concentrated (i.e., they have a higher analysis), at a rate of almost 2 percent a year in terms of nutrient content. Because of its high analysis, urea is expected by some to become the dominant source of dry nitrogen within a few years.[28] While there are disadvantages to urea, it is generally less corrosive and has better storage ability than other concentrated forms of nutrients. Urea, however, has a slower response rate compared with ammonium nitrate

[24] See Footnote 15a. But removal of crop residues could change fertilizer requirements for subsequent crops.

[25] Statistics Canada, *Detailed Energy Supply and Demand in Canada*, Catalogue No. 57-207 Annual.

[26] Z. Piracha, "Fertilizers," *Market Commentary on Farm Inputs*, Policy and Economics Branch, Agriculture Canada, Dec. 1977.

[27] FAO, *Monthly Bulletin of Agricultural Economics and Statistics*, Rome, Mar. 1977.

[28] H.A. Kittams, W.N. Sutherland and J.C. Kramer, "The Shift is to Urea," *Farm Chemicals*, Aug. 1977, pp. 42, 44.

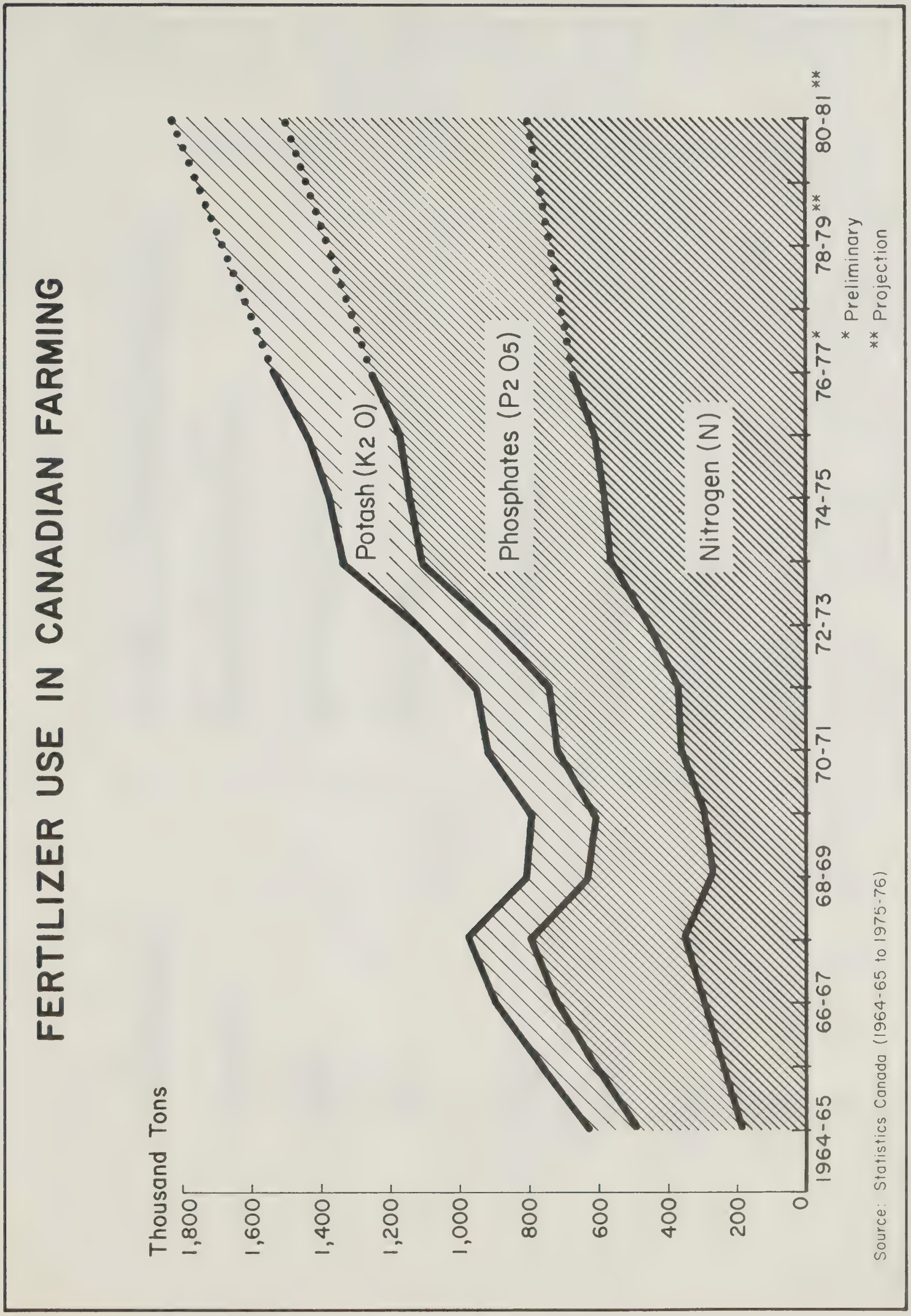
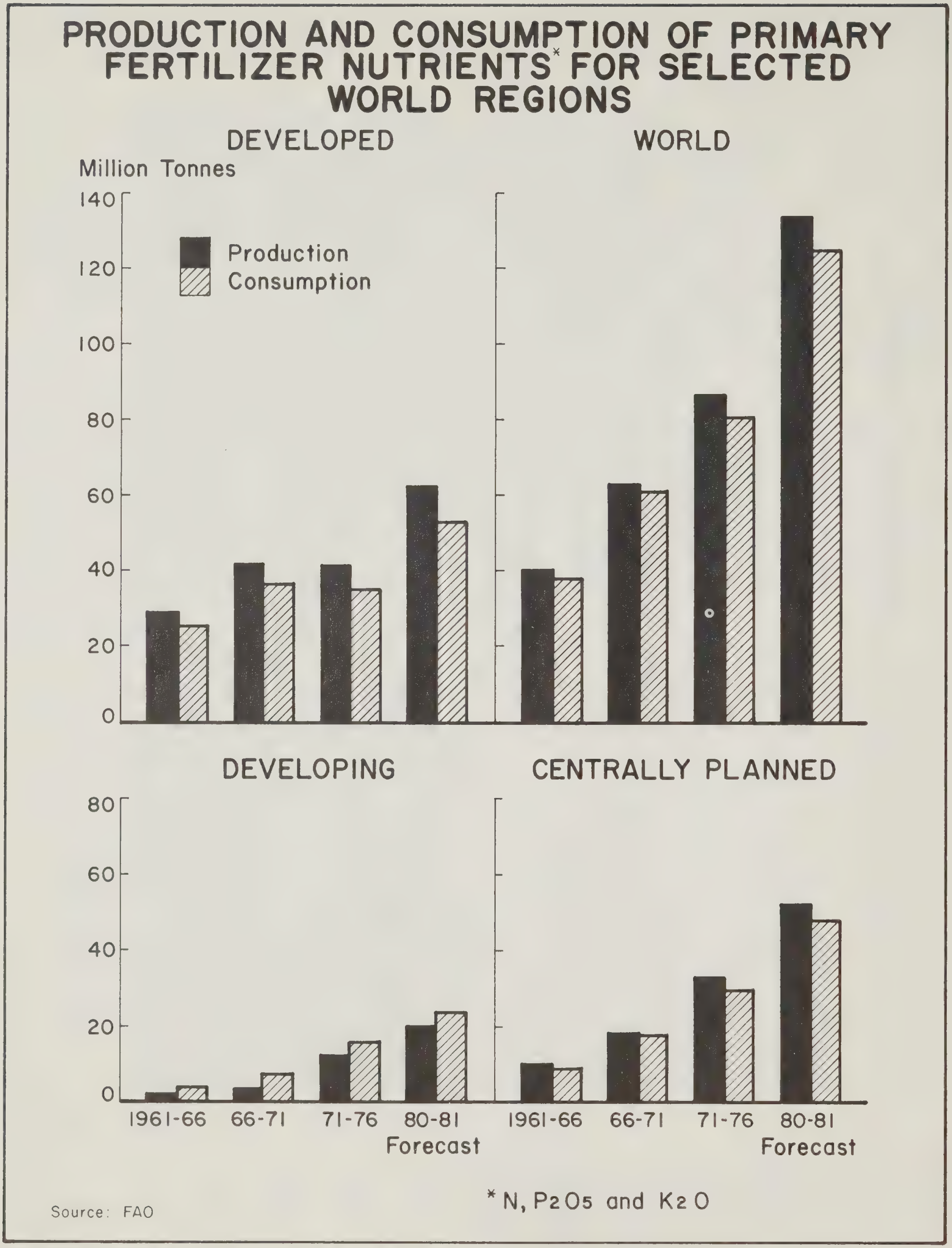

FERTILIZER USE IN CANADIAN FARMING
Thousand Tons
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1964-65
66-67
68-69
70-71
72-73
74-75
76-77*
78-79**
80-81**
Potash (K2 O)
Phosphates (P2 O5)
Nitrogen (N)
* Preliminary
** Projection
Source: Statistics Canada (1964-65 to 1975-76)

Figure 9



PRODUCTION AND CONSUMPTION OF PRIMARY FERTILIZER NUTRIENTS* FOR SELECTED WORLD REGIONS
DEVELOPED
WORLD
Million Tonnes
140
120
100
80
60
40
20
0
Production
Consumption
DEVELOPING
CENTRALLY PLANNED
80
60
40
20
0
1961-66
66-71
71-76
80-81
Forecast
1961-66
66-71
71-76
80-81
Forecast
* N, P2O5 and K2O
Source: FAO

Figure 10

when applied in the spring to small grains and pastures. This means that for some parts of the country urea is not technically suitable. Urea also has a higher energy cost per unit of nitrogen than does anhydrous ammonia. Also, in recent years an increasing number of farmers, especially corn producers, have benn using liquid nitrogen solutions of 28 or 32 percent. Since nitrogen solutions are highly corrosive, special storage equipment is required. Another example of the switch to higher analysis fertilizers is the increased use of anhydrous ammonia which has an even higher percentage of nitrogen than urea. Increased use of anhydrous ammonia, however, should level off in favor of urea because the latter is easier to apply and generally less costly to transport and store.[29]

Bacteria that convert atmospheric nitrogen into forms plants can use could substitute for some of the nitrogen fertilizers now being produced from natural gas. Although only legume crops can presently fix nitrogen, crops that succeed them benefit from the nitrogen build-up in the soil. Researchers at Agriculture Canada have estimated that inoculants costing about one dollar can fix 200 pounds of nitrogen in an acre of alfalfa.[30] This amount of nitrogen costs about $40. Research is also underway, both in Canada and elsewhere, on nitrogen-fixation by bacteria for non-legume crops.

Another change that is occurring in the fertilizer industry is the development of slow-release nitrogen materials and the addition of chemical inhibitors that reduce nitrogen losses.[31] Because nitrogen is readily soluble in water, losses can occur during the growing season. The additional costs of manufacturing these forms of slow-release nitrogen per unit of plant food, however, presently offset the benefits of commercial use. Instead they are used in home gardens and lawns, etc., where the convenience offsets the cost for the limited quantities used. But this is an illustration of the possibilities which exist for improving efficiency in nitrogen fertilizer use to reduce the energy requirements in its manufacture.

Finally, while all of the nitrogen fertilizer being produced in Canada is from natural gas, coal, which this country has in abundance, could be used as a source. The technology is well defined and coal is used as a source in countries without natural gas.

PESTICIDES

Pesticide consumption in Canadian farming has been increasing rapidly in recent years, especially since 1972, but sales levelled off in 1976 and 1977. The trend in sales in current dollars compared with pesticide prices is shown in Figure 11.[32] The figure shows that most of the sales increase in Canada has been in real terms.

As in Canada, world sales have shot up quickly and are expected to continue rising. One prediction places world pesticide sales by 1984 at $10 billion, 1977 U.S. dollars, almost double 1974 sales (Figure 12).[33] The United States is the world's largest market for crop production chemicals and is expected to continue to still be by 1984, accounting for a third of the world market. These predictions show herbicides continuing to account for the largest proportion of sales. The principal constraints on even faster growth rates are new pesticide registration requirements, controls on use both in developed and developing countries (intended to protect the health of the public and the environment) and rapidly increasing research and development costs.

Since most pesticides are manufactured from basic chemicals such as ethylene and benzene which are derived in intermediate stages from natural gas or crude oil, the growth in production and consumption of pesticides represents an increasing fossil energy requirement. As was shown in Figure 5, herbicides account for 7 percent of the energy used to produce corn in Ontario. The question is, therefore, are there any alternatives to increased pesticide consumption or can more efficient use be made of the present use of fossil energy in the form of pesticides?

The agricultural chemicals field is highly complex – 10 to 15 new active ingredients enter the system each year. Nor does the usual form of analysis of demand and supply for inputs lend itself readily to predicting the

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[29] I.F. Furniss, R.K. Eyvindson and C.D. Crober, "Fertilizers: Situation 1974 and Outlook 1975," *Canadian Farm Economics,* Vol. 10, Feb. 1975, pp. 18-19.

[30] "Biological Nitrogen Source," *News and Features,* Agriculture Canada, Ottawa, June 4, 1976.

[31] See Footnote 29.

[32] The index of agricultural chemical prices used is that for the United States since no similar index exists for Canada. Generally, agricultural chemical prices in the two countries follow much the same trend. While the U.S. index, however, indicates a decline in prices in 1977 from year-earlier levels, Canadian prices were up probably 5 percent. This would be partly because of the devaluation of the Canadian dollar and to the effect this would have on agricultural chemical prices in Canada, most of which are imported from the United States.

[33] "A Look at World Pesticide Markets," *Farm Chemicals,* Sept. 1977.

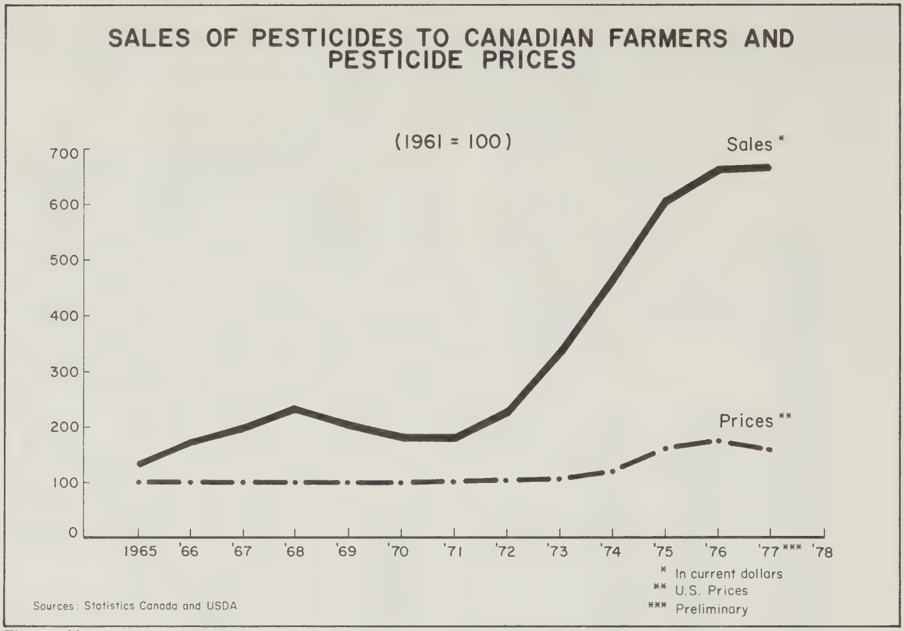

Figure 11

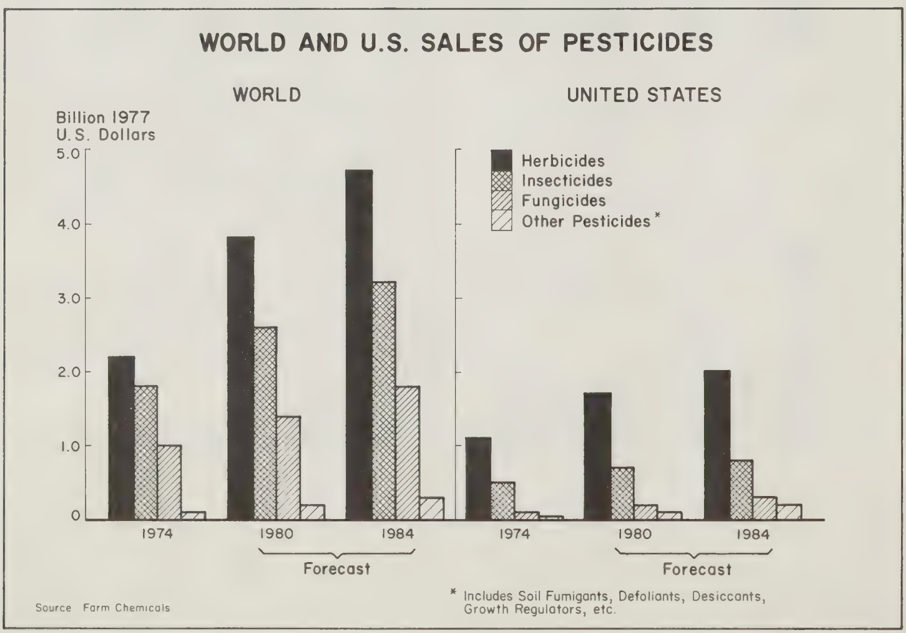

Figure 12

agricultural demand. Demand for pesticides is more a function of the total area grown of particular crops than of pesticide-crop price ratios. But supply is affected by the relative profitability among end uses of the basic materials, which are many. For example, agricultural chemicals are made from the same basic ingredients as anti-freeze, vinyls, acrylics and synthetic fibers.

Alternatives to the use of agricultural chemicals are being continually sought, both in terms of improved cultural practices and biological control agents, as well as the more efficient utilization of existing actives and the development of new ones. One of the significant changes now under way is the change-over from the ester to the amine form of phenoxy herbicides. The amine form is less volatile and therefore less subject to drifting problems, making it more acceptable environmentally.

Agricultural chemicals can be used to reduce the total energy input in the production of certain crops through savings in energy requirements for field operations by fossil-fueled machinery. Work at Agriculture Canada research stations in the Prairie Provinces has centered on "chemical fallow" practices for growing wheat.[34] By "chemical fallow" the researchers mean the substitution of herbicides for tillage operations to control weeds during the summerfallow period. Tests so far indicate that yields are as good or better than those from conventional practices with nitrogen accumulation and moisture conservation being equal. Advantages noted were marked improvements in trash conservation and erosion control. Staff are also studying zero tillage practices under continuous cropping systems.

Work by Agriculture Canada researchers in New Brunswick has been directed towards reducing the number of sprayings needed to protect potatoes from late blight disease.[35] Most growers now spray as many as 8 to 10 times in a growing season. By analyzing the interactions of rainfall, temperature and humidity, it was possible to reduce the number of applications while still providing satisfactory blight control. Work is continuing to introduce another variable, the incidence of blight. By including this information, the researchers expect to be able to reduce the number of sprayings a season to only four or five.

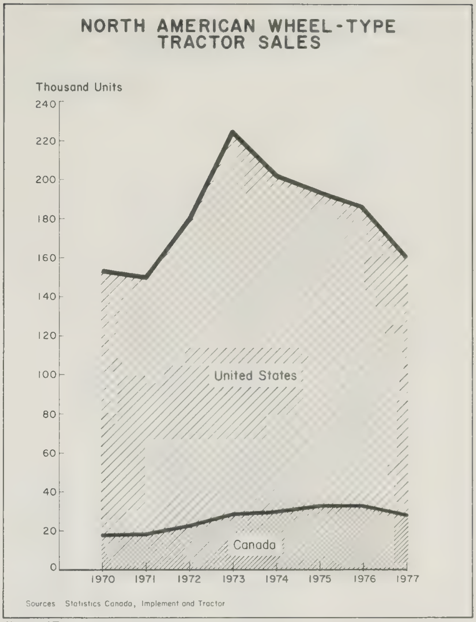

Figure 13

MACHINERY

Farm machinery accounts for about 5 percent of the total indirect energy consumption in Canadian farming, that is, the energy embodied in machinery in the manufacturing process. But the direct energy use in farming in field operations is much larger, 67 percent, for the sector as a whole. For some crops, such as corn, the relative total energy use is much less in field operations because of the larger indirect demand in the form of fertilizer. With the worldwide growth in agricultural mechanization, however, the major implication in terms of energy consumption is the direct use of fossil fuels.

Unit tractor sales in Canada reached a peak in 1976 and have been decreasing ever since (Figure 13). Annual sales in the United States peaked in 1973 and have also been declining since. But this is only part of the picture since fuel consumption in farming continues to increase. During the last decade several changes have been taking place in the tractors produced for the North American market. One of these changes is illustrated in Figure 14, which shows that diesel tractors have been accounting for an increasing share of U.S. tractor production since

[34] "The Move to Zero Tillage," *News and Features*, Agriculture Canada, Ottawa, May 6, 1977.

[35] "Cutting Costs and Chemicals," *News and Features*, Agriculture Canada, Ottawa, Sept. 23, 1977.

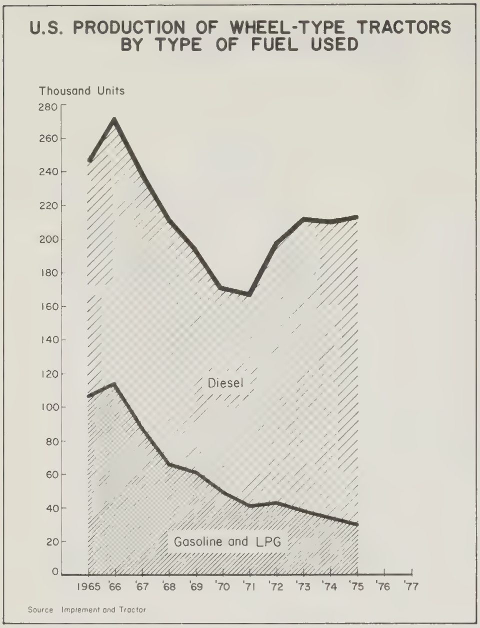

Figure 14

1971.[36] Since 1965 production of diesel tractors has risen from about 55 percent of the total to over 85 percent. Also, larger tractors have taken more and more of the market. Tractors of 100 horsepower and over have increased from about 6 percent of total U.S. production to over 47 percent in the same period. Finally, Figure 15 shows the recent trends in numbers of tractors on farms in the major economic regions of the world. While the annual growth rates in the developing and centrally-planned economies are higher than in the developed countries, the rates have not been increasing and the developed countries still account for almost three quarters of the total number on farms.

Since Canadian agriculture is heavily tractor orientated, options that can reduce the fuel demands of agriculture while still maintaining the current level of mechanization are needed.

Some of the trends reviewed indicate that economic forces have been encouraging the use of more fuel-efficient tractors with lower fuel costs per unit of land. The trend to diesel engines is a good example. With its high thermal efficiency and ability to finely meter fuel, it is 25 percent more efficient in quantitative fuel use than the gasoline engine.

A more recent development that could increase the fuel efficiency of tractors is the constant horsepower engine concept.[37] While engines incorporating this design concept are similar in many ways to conventional tractor engines, they incorporate features which enable the engine to maintain an almost constant rated horsepower output throughout the operating range of engine speeds. One of the modifications applied is a torque modifier, which is used to limit the fuel flow to the engine at rated speed. Among the advantages claimed for this engine are that since the engine is operated in the normal range of speeds it is not as subject to overloading and fuel economy is maximinized throughout the normal range of working speeds.

Farm machinery industry sources are now forecasting the following developments for farm machinery in the 1980s in North America.[38]

- The medium farm unit will continue to grow; it will use larger equipment and total reliability will be demanded. Higher fuel costs and larger machines will force greater machinery use and application efficiency. A recent USDA study in the winter wheat areas of Washington and Oregon supports this conclusion.[39] The study noted that if an operator acquires a large four-wheel-drive tractor (222 dbhp and over) for any farm size within the operational capability of a conventional crawler tractor, the machinery cost per acre will increase unless the fixed costs can be spread over a larger acreage, increasing the probability that farm operations will enlarge to reduce costs to the pre-acquisition cost. The study found that the break-even point between the least-cost machinery costs for the conventional crawler tractor and the four-wheel-drive tractor was a farming operation of 2,000 acres.
- Power units will continue to become larger and diesel engines even more dominant. While the number of unit tractor sales seems likely to continue to decrease, the total horsepower sold will continue to increase.
- Rotating equipment designs in use for hay and grain harvesting equipment will increase because of the ad-

[36] The Canadian market for most tractors is supplied largely from the United States.

[37] Pierce Fulkerson, "Rating the Total Performance of Farm Tractors," *Farm and Power Equipment*, Oct. 1977, pp. 30-31.

[38] George McConeghy, Jr., "Farm Machinery in the 1980s," *Implement and Tractor*, Jan. 21, 1977.

[39] Gordon E. Rodewald, Jr., and Raymond J. Folwell, "Farm Size and Tractor Technology," *Agricultural Economics Research*, Vol. 29, No. 3, July 1977, pp. 82-89.

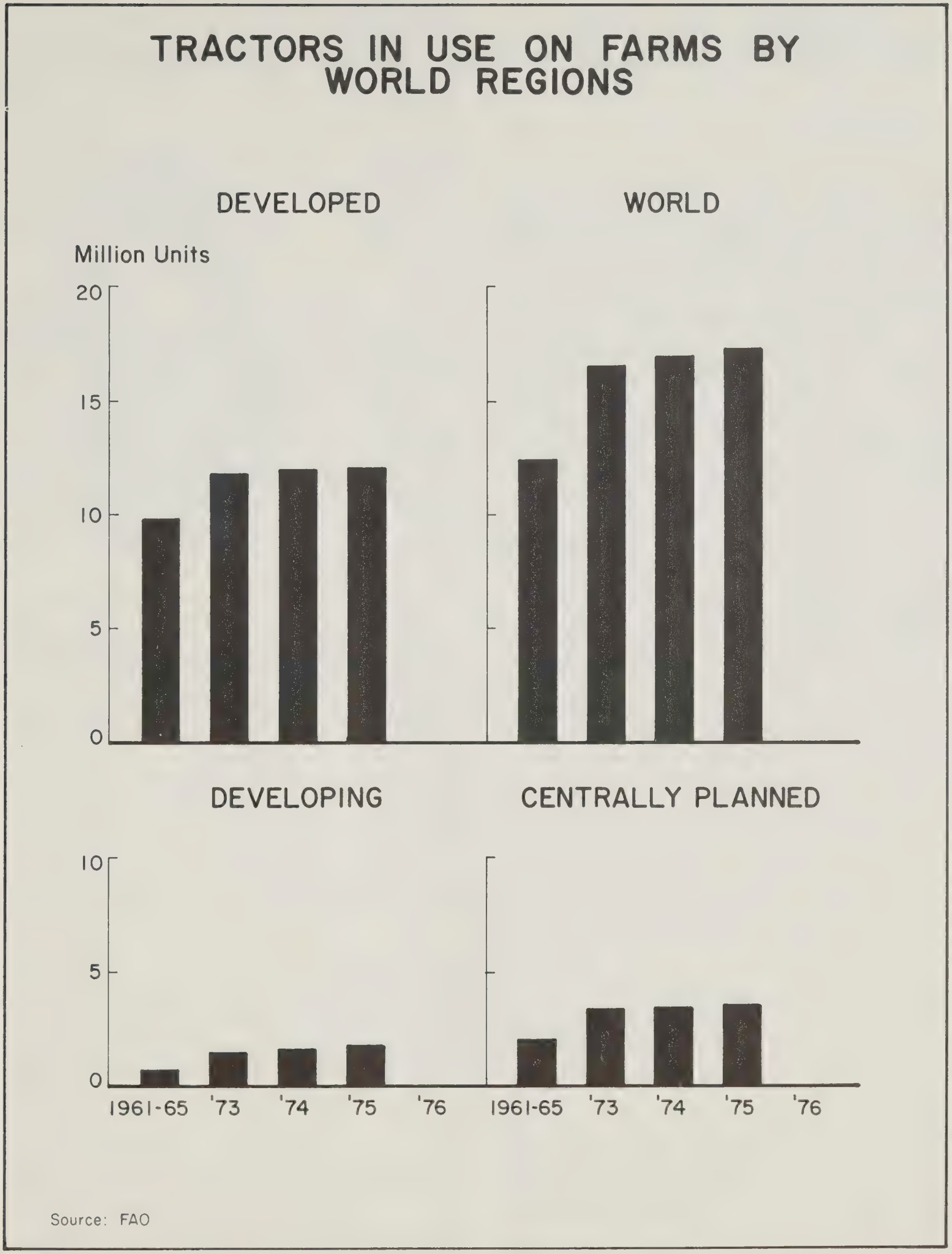
TRACTORS IN USE ON FARMS BY WORLD REGIONS
DEVELOPED
WORLD
Million Units
20
15
10
5
0
DEVELOPING
CENTRALLY PLANNED
10
5
0
1961-65
'73
'74
'75
'76
1961-65
'73
'74
'75
'76
Source: FAO

Figure 15

vantages this design offers over reciprocating equipment. These include a simpler design often associated with increased reliability and a larger inherent capacity.

– The trend to less frequent tillage, shallower depths of tillage and combined field operations will accelerate.

In the past, mechanization in agriculture substituted largely for labor. It will continue to do so for certain crop and livestock operations, but with the increasing cost of fuel, the goal will be to use this increasingly scarce resource more efficiently.

SUMMARY AND CONCLUSIONS

This paper has reviewed the trends in consumption of selected purchased farm inputs, especially those related to energy. It has discussed some of the developments taking place to find substitutes for fossil fuels from agricultural sources and improve efficiency in the use of fossil energy in farming. Even so, fossil fuels will continue to be an important input in agriculture and in the manufacture of certain farm inputs for many years to come. Progress is being made in developing alternatives and improving efficiency in use but large changes in relatively short periods are unlikely. The pace of the changes will be determined largely by the costs of alternative energy supplies to farmers, distributors and farm input manufacturers. If adjustments through the market system come too slowly, however, it might become necessary to intervene in the market through fiscal incentives or consumption constraints.

In its analysis of the energy supply outlook for agriculture, the 1976 State of Food and Agriculture Report of the FAO concludes that agriculture's needs are certainly not a major factor in the pressure on overall energy supplies.[40] Hence agriculture itself provides little scope for economies of world impact. But the sector's small demand on total energy resources clearly deserves the highest priority, says the FAO. In Canada, the use of petroleum products in farming and food processing has been assigned top priority in any fuel allocation program.[41]

In this article it has not been possible to consider all of the alternatives to fossil fuels in all their applications which are being investigated. These alternatives include non-motive applications such as solar, wind and biomass sources. Some of the applications of these sources are in space and water heating, low temperature grain and forage drying, more energy-efficient greenhouses, waste heat source use and supplementary power or fuel sources.[42]

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[40] Published in December 1977. See Section 3, Energy and Agriculture.

[41] Energy Supplies Allocation Board, *Petroleum Products Allocation Procedures,* Ottawa, Canada, 2nd Edition, Aug. 1975.

[42] For a discussion on these alternatives see: Gordon E. Timbers, "Alternate Sources of Energy," *Agrologist,* Vol. 6/4, Autumn 1977.

FAMILY EXPENDITURE PATTERNS IN CANADA ACCORDING TO SOCIO-ECONOMIC CHARACTERISTICS

Between 1969 and 1974 urban Canadians experienced a marked change in family expenditure patterns. Income after taxes increased 55 percent and total current consumption rose 48 percent. The proportion of income allocated to essential goods and services decreased, while that spent on furnishing and equipment, recreation and miscellaneous expenses increased.

*Danielle Karamchandani**

INTRODUCTION

Significant variations in consumer expenditure patterns have been related to changes in the general socio-economic condition of the spending units. Socio-economic characteristics can include the education level and occupation of the household head, race, religion, stage of the life cycle, income level, age of the household head and tenure class. This paper does not statistically analyze and measure the relationships between some of the listed factors and consumer behavior; these have been covered in recent publications (e.g., Hassan and Johnson). It does, however, provide an overall view of their effects on consumer spending habits.

This author analyzed the average Canadian household's expenditure pattern for major commodity groups, using data from three family expenditure surveys. The specific objectives were to describe the expenditure patterns among 13 groups of goods and services;[1] to analyze variations in expenditure pattern by family life cycle, income quintile, age of the family head and tenure class; and to examine trends in family expenditure patterns from 1969 to 1974.

THE DATA

The data used in this study are derived from three surveys by Statistics Canada – the 1969 Family Expenditure in Canada and the 1972 and 1974 Urban Family Expenditure surveys – designed to provide information on families and unattached individuals living in private households. (A family or spending unit is a group of persons dependent on a common income for the major expense items and living in the same dwelling, or one financially independent individual living alone.)

The 1969 survey (from which 15,140 spending units provided usable schedules) was conducted in January, February and March 1970 but the data refer to 1969. The survey was national in scope and included both rural and urban centers. The 1972 survey was carried out in February and March 1973 but covers 1972. The method was similar to that of the earlier survey; however, the main sample (from which 3,562 spending units provided usable schedules) included only eight major urban centers.[2] The survey for 1974 was conducted in

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[1] Includes food, shelter, household operation, furnishing and equipment, clothing, personal care, medical and health care, smoking and alcoholic beverages, travel and transportation, recreation, reading, education and miscellaneous expenses.

[2] St. John's, Halifax, Montreal, Ottawa, Toronto, Winnipeg, Edmonton and Vancouver.

January, February and March 1975. It was similar to the one in 1972, but included six more cities,[3] and provided 5,389 usable spending units.

Sample groups (mostly urban) comparable to those in the 1972 survey were constructed from those of the 1969 and part of the 1974 surveys to include the same eight cities. The 1974 sample was reduced for spending units of all classes and for family expenditures by income quintiles only.[4]

SOCIO-ECONOMIC CHARACTERISTICS

Data compiled by Statistics Canada on family expenditure were used for each of the given socio-economic characteristics or partitions defined below. The availability of information about each spending unit restricts further classification, one of the limitations of the present study.

Life Cycle

Families can be classified by life cycle into three major categories – unattached individuals, married couples (with or without children) and other families (married couples with relatives other than unmarried children, single-parent families and other families of relatives or non-relatives). Spending units are then grouped by age of head – under 45, from 45 to 64 and 65 and over.[5] The life cycle concept is useful because family needs, income, assets and debts and expenditures vary at different stages. Because this concept combines trends in earning power with demands placed on income, it is one of the most useful ways of classifying individuals and families.

Income Quintiles

Income quintiles refer to the five income categories under which a spending unit might be grouped. The first fifth consists of the spending units with the lowest incomes, the second with the second lowest incomes, etc. Income includes gross income from wages and salaries, net income before taxes from self-employment, receipts from military pay and allowances, gross receipts from roomers and boarders, net rental, family allowances, interest and dividends, all pensions, workmen's compensation and unemployment insurance benefits, regular receipts from insurance policies and annuities and miscellaneous regular income receipts.

Tenure Class

Tenure class identifies the type of home ownership – homeowners (a member of the spending unit living in a dwelling which he has owned for the entire survey year) with and without mortgages, regular tenants and other tenants (roomers, tenants rent-free and mixed tenure). As home ownership accounts for a substantial proportion of wealth for many families, the numerous results from such classification can reveal many anomalies in consumer behavior.

Age of Family Head

The expenditure classification by age of household head reflects the changes in needs and wants related to the variations in income, family size and activities as the age of the family head increases. Four age groups were selected for this study – under 25, 25 to 44, 45 to 64 and 65 and over. An interesting objective of this partitioning was to find out whether or not age is sufficient for characterizing differences in life cycle consumption behavior (Denton and Spencer).

INCOME AND EXPENDITURE PATTERN

To appraise the sufficiency of family incomes in comparison with total current consumption for general consumers and particular groups, data on average income, average consumption, family size and number of families, i.e., observations for each of the characteristics discussed in the preceding section were assembled (Table 1).

Before examining income and expenditure patterns by socio-economic characteristics it is interesting to note the following trend for families and unattached individuals of all classes. In 1974 the average family income after taxes reached $12,044, a 55-percent increase above the 1969 level. Average total current consumption increased 48 percent to $10,536. From 1969 to 1974, on a per-capita basis, income after taxes rose 59 percent to $4,055 while total current consumption increased 51 percent to $3,547. The three surveys

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[3] Saint John, Quebec, Thunder Bay, Saskatoon, Regina and Calgary.

[4] The 1974 classifications of family expenditure by family life cycle, tenure class and age of head have not been transformed to eight cities as has been done elsewhere and still contain information for 14 cities. The results are almost identical to those of the reduced samples.

[5] In husband-wife families, the husband was considered as head; in one-parent families with unmarried sons or daughters, the parent was considered head; in other types of spending unit, the head was the person mainly responsible for the maintenance of the unit.

TABLE 1. AVERAGE INCOME PER FAMILY, AVERAGE CURRENT CONSUMPTION, FAMILY SIZE AND NUMBER OF FAMILIES BY SOCIO-ECONOMIC CHARACTERISTICS, 1969[a] 1972 and 1974[b]

Socio-economic	Income Before Taxes			Income After Taxes			Total Current Consumption			Family Size			Families		
Characteristic	1969	1972	1974	1969	1972	1974	1969	1972	1974	1969	1972	1973	1969	1972	1974
	–				$				–	–		No.			–
All Classes	9,175	11,118	14,668	7,761	9,243	12,044	7,134	8,191	10,536	3.04	2.99	2.97	4,552	3,562	4,518
Family Life Cycle															
Unattached individuals, under 45	5,617	6,978	8,483	4,727	5,719	6,908	4,663	5,302	6,786	1.00	1.00	1.00	255	241	486
Unattached individuals, 45-64	4,722	5,542	8,185	4,038	4,654	6,815	3,676	4,095	5,317	1.00	1.00	1.00	215	179	392
Unattached individuals, 65 and over	2,610	3,232	4,208	2,431	2,964	3,897	2,266	2,795	3,605	1.00	1.00	1.00	240	220	530
Married couples, head under 45 without children	11,231	13,007	16,384	9,315	10,621	13,330	8,307	9,024	11,705	2.07	2.08	2.10	377	334	565
Married couples, head under 45 with children	10,608	12,541	16,710	8,960	10,408	13,578	8,548	9,815	12,415	4.36	4.21	4.13	1,458	1,023	1,760
Married couples, head 45-64 without children	11,787	13,659	18,179	9,764	11,260	14,821	8,161	9,366	11,833	2.76	2.75	2.83	559	467	734
Married couples, head 45-64 with children	12,567	16,202	19,969	10,367	13,124	15,982	9,482	11,075	13,789	4.70	4.86	4.67	472	306	568
Married couples, head 65 or over	6,623	7,752	8,724	5,912	6,723	7,697	5,113	5,549	6,425	2.28	2.22	2.21	288	215	569
All other families	9,356	11,232	14,022	8,151	9,546	11,934	7,611	8,430	10,627	3.55	3.38	3.25	684	577	1,026

– continued –

TABLE 1. AVERAGE INCOME PER FAMILY, AVERAGE CURRENT CONSUMPTION, FAMILY SIZE AND NUMBER OF FAMILIES BY SOCIO-ECONOMIC CHARACTERISTICS, 1969[a], 1972 AND 1974[b] (Concluded)

Socio-economic Characteristic	Income Before Taxes			Income After Taxes			Total Current Consumption			Family Size			Families		
	1969	1972	1974	1969	1972	1974	1969	1972	1974	1969	1972	1974	1969	1972	1974
	—				$				—	—			No.		—
Family Income Quintiles															
First	2,512	3,294	4,373	2,385	3,083	4,141	2,873	3,455	4,549	1.60	1.65	1.73	824	715	1,323
Second	5,732	7,113	9,242	5,114	6,236	8,053	5,244	6,083	8,120	2.61	2.61	2.54	920	728	962
Third	8,271	10,239	13,330	7,207	8,696	11,188	6,938	8,136	10,374	3.45	3.14	3.17	960	726	773
Fourth	11,042	13,447	17,832	9,430	11,192	14,687	8,673	9,867	12,586	3.64	3.55	3.47	952	715	742
Fifth	18,316	21,496	28,612	14,670	17,007	22,151	11,940	13,412	17,050	3.88	3.97	3.94	896	682	722
Tenure Class															
Homeowners with mortgage	12,219	14,968	19,652	10,229	12,227	15,848	9,170	10,804	13,603	4.20	4.05	3.99	1,354	1,044	1,809
Homeowners without mortgage	9,799	11,152	14,684	8,227	9,332	11,989	6,968	7,527	9,644	2.90	2.93	2.91	829	643	1,334
Tenants, regular	7,979	9,501	11,472	6,821	7,992	9,672	6,568	7,277	9,026	2.70	2.57	2.47	1,937	1,618	2,954
Other	5,810	7,662	11,764	4,980	6,436	9,684	4,816	5,625	8,574	1.80	1.94	2.20	428	257	533
Age of Head															
under 25	6,152	7,429	10,344	5,295	6,345	8,766	5,467	6,673	8,757	1.81	1.86	1.99	309	261	548
25 - 44	10,169	12,081	15,703	8,578	9,993	12,791	8,084	9,068	11,630	3.59	3.43	3.39	2,090	1,603	2,803
45 - 64	10,471	12,883	16,654	8,748	10,610	13,606	7,684	8,965	11,230	3.14	3.14	3.12	1,519	1,166	2,049
65 and over	4,818	5,861	7,280	4,343	5,176	6,469	3,870	4,416	5,446	1.71	1.75	1.77	630	532	1,230

[a]To reduce the sample to eight cities, data for Quebec city, Regina and Saskatoon were subtracted from the data for the 11 cities covered in the 1969 survey.

[b]The 1974 figures are for 14 cities.

Sources: Statistics Canada, *Family Expenditure, 1969*, Selected Tables, Mimeographed, Ottawa, 1973.
Statistics Canada, *Urban Family Expenditure, 1972,* Catalogue No. 62-541, Ottawa, March 1975.
Statistics Canada, *Urban Family Expenditure, 1974,* Catalogue No. 62-544, Ottawa, 1977.

also suggested little variation in the family size over this period – approximately three members.

Life Cycles

Substantial variations in average income and total current consumption can be observed among and within the samples' partitions. This section summarizes those variations and is based on Table 1.

The highest average family income after taxes was for married couples in the 45 to 64 age group; however, married couples with children had higher incomes, $15,982 ($10,367),[6] than married couples without children, $14,821 ($9,764). The group with the next largest income after taxes was married couples under 45, with a slight difference between couples with and without children. Unattached individuals' income seemed to reach a peak before 45. Through different stages of the life cycle, total current consumption for a family follows a trend similar to that for the family's income; however, the presence of children is always marked by larger amounts of money being spent on total goods and services.

On a per-capita basis, unattached individuals under 65 had the highest income after taxes, married couples without children followed with substantially lower incomes. Average per-capita total current consumption of unattached individuals of all ages as well as of married couples without children ranged from $3,605 ($2,266) to $6,786 ($4,663), while those for families with children and retired couples (over 65) were substantially lower, ranging from $2,907 ($2,243) to $3,006 ($1,961).

Income Quintiles

In 1974 expenditures of families in the first and second income quintiles ($4,549 and $8,120) exceeded their incomes after taxes ($4,141 and $8,053). The opposite was true for families in all other income groups, especially those in the fifth quintile, for whom income after taxes exceeded total current consumption by 23 (19) percent. From 1969 to 1974, while income increased more than 62 percent for most spending units, families in the third income bracket recorded a maximum 60-percent increase in per-capita total current consumption.

[6] The 1969 figures are in parentheses.

Tenure Class

Per capita income after taxes of those living in the other tenant class reached $4,402 ($2,767) while the income of homeowners and regular tenants varied between $3,916 ($2,526) and $4,120 ($2,837). Total per capita expenditures on goods and services did not vary significantly between tenure classes; in 1974 total current consumption ranged from $3,314 to $3,897. In the study period there was a substantially lower increase in both income after taxes (45 percent) and total current consumption (38 percent) for homeowners without mortgages compared with those in all other tenure classes. Hence homeowners without mortgages and spending units whose heads are 65 or over who have possibly paid off their mortgages could be the same people.

Age of Head

The family's income gradually rose from $8,766 ($5,295) to $13,606 ($8,748) as the age of the head went from under 25 up to 64; then it suddenly dropped to $6,469 ($4,343) for those over 65. Total current consumption for families in the 25 to 44 and 45 to 64 groups reached an averaged of $11,630 ($8,084) and $11,230 ($7,684) while that for families in the under 25 and over 65 groups was $8,757 ($5,467) and $5,446 ($3,870). On a per-capita basis, it is those families whose head is under 25 who have the highest per-capita income and total current consumption.

EXPENDITURE SHARES OF INCOME

The effects of socio-economic forces on consumer behavior are revealed by the generally consistent patterns formed by relationships between variations in expenditure shares and variations in socio-economic characteristics. Some of these patterns (based on Table 3) are examined in this section. The absolute per-capita current dollar expenditures which are discussed in terms of shares of income after taxes are in Table 2. The shares of total current consumption attributed to the 13 major expenditure groups are not included here, but are available on demand for each socio-economic group. Shares of total expenditures for families and unattached individuals of all classes, however, are illustrated in Figure 2.

The allocation of income after taxes to major goods and services by families and unattached individuals of all classes for 1974 compared with that for 1969 is as follows: food 20 (21) percent, shelter 18 (19) percent, travel and transportation 14 (14) percent, clothing 8 (9)

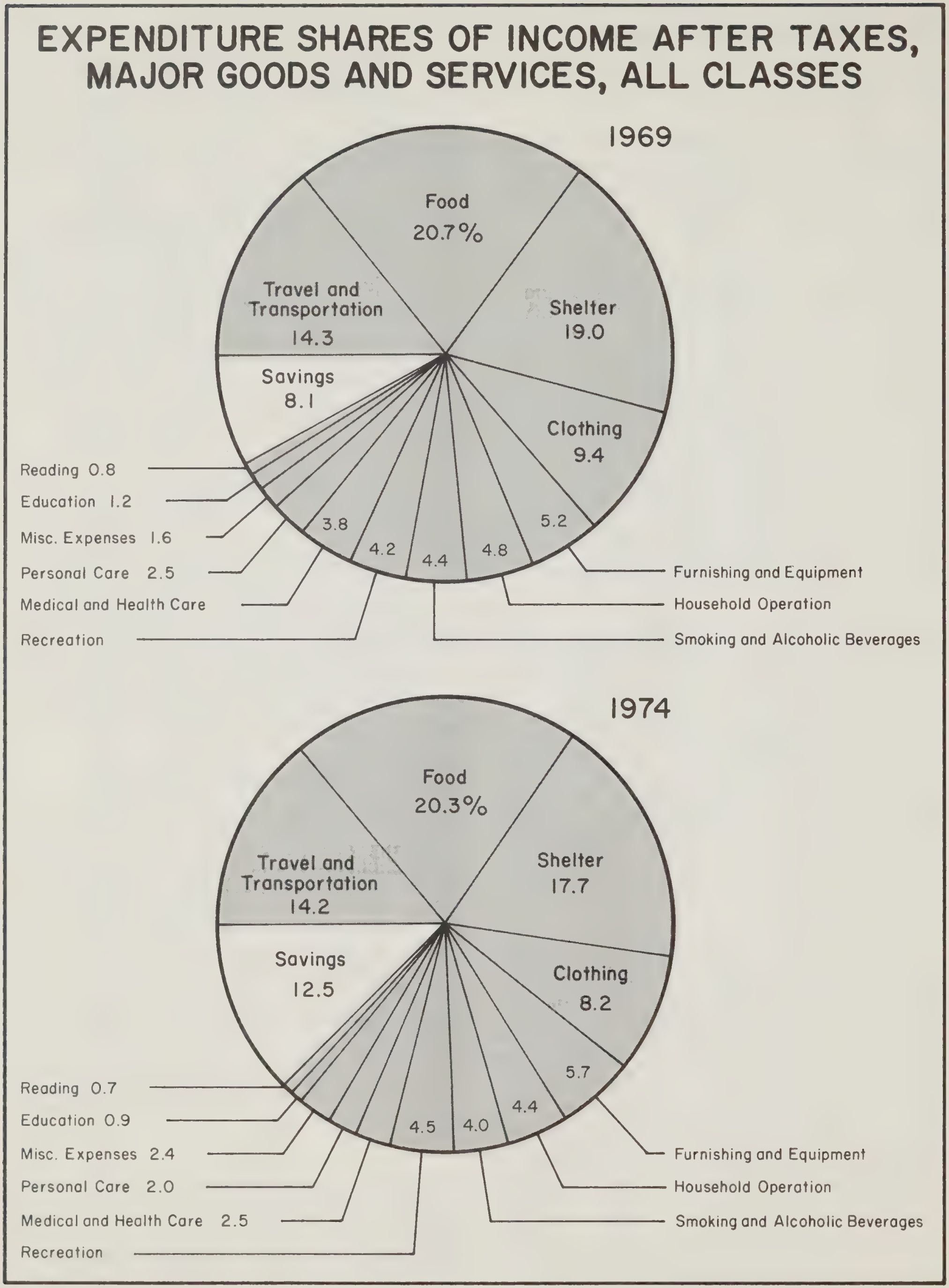
EXPENDITURE SHARES OF INCOME AFTER TAXES, MAJOR GOODS AND SERVICES, ALL CLASSES
1969
Food 20.7%
Shelter 19.0
Travel and Transportation 14.3
Savings 8.1
Clothing 9.4
3.8
4.2
4.4
4.8
5.2
Reading 0.8
Education 1.2
Misc. Expenses 1.6
Personal Care 2.5
Medical and Health Care
Recreation
Furnishing and Equipment
Household Operation
Smoking and Alcoholic Beverages
1974
Food 20.3%
Shelter 17.7
Travel and Transportation 14.2
Savings 12.5
Clothing 8.2
5.7
4.4
4.0
4.5
Reading 0.7
Education 0.9
Misc. Expenses 2.4
Personal Care 2.0
Medical and Health Care 2.5
Recreation
Furnishing and Equipment
Household Operation
Smoking and Alcoholic Beverages

Figure 1

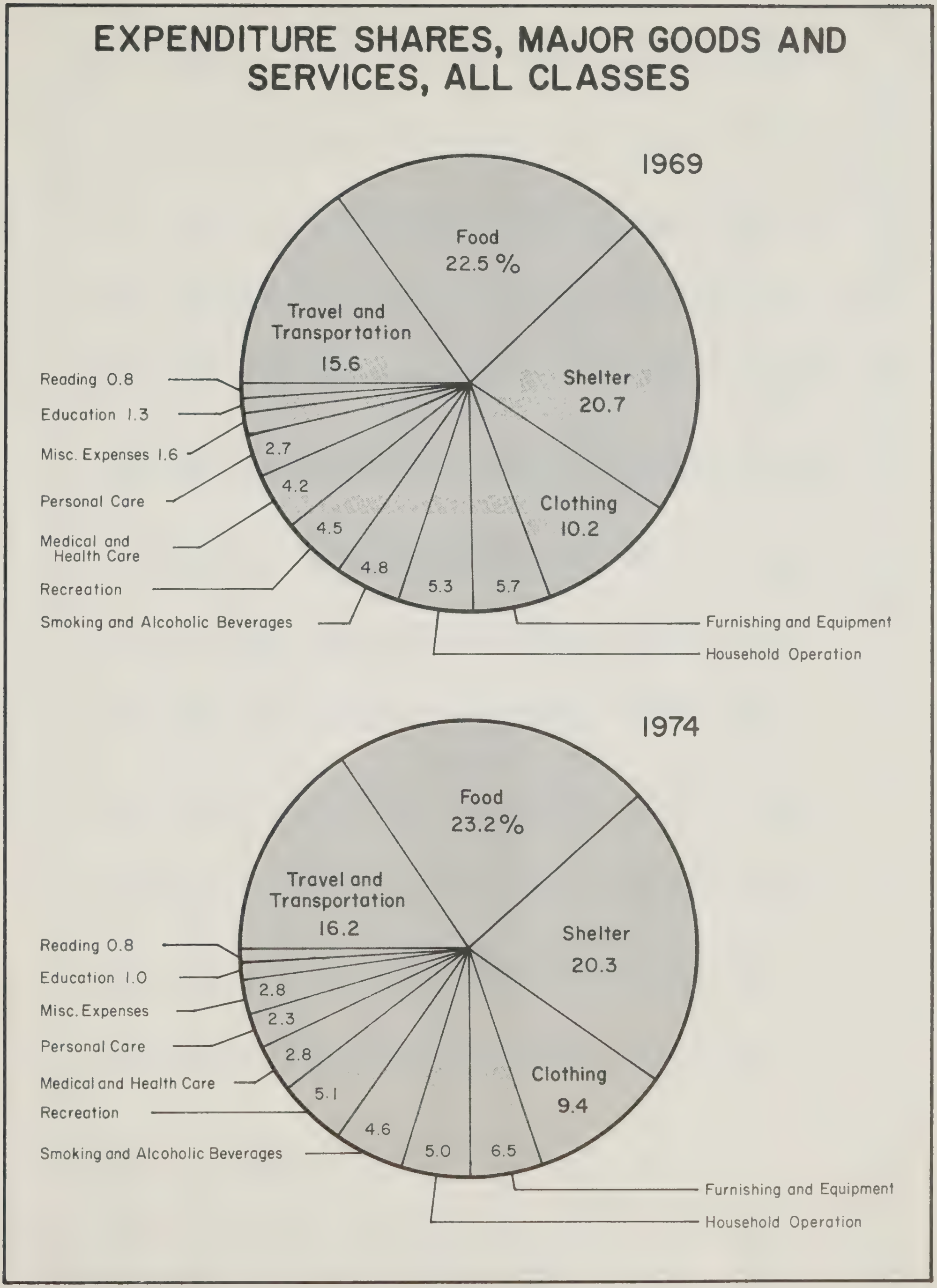
EXPENDITURE SHARES, MAJOR GOODS AND SERVICES, ALL CLASSES
1969
Food
22.5 %
Travel and Transportation
15.6
Shelter
20.7
Clothing
10.2
Reading 0.8
Education 1.3
Misc. Expenses 1.6
Personal Care
2.7
Medical and Health Care
4.2
Recreation
4.5
Smoking and Alcoholic Beverages
4.8
5.3
5.7
Furnishing and Equipment
Household Operation
1974
Food
23.2%
Travel and Transportation
16.2
Shelter
20.3
Clothing
9.4
Reading 0.8
Education 1.0
Misc. Expenses
2.8
Personal Care
2.3
Medical and Health Care
2.8
Recreation
5.1
Smoking and Alcoholic Beverages
4.6
5.0
6.5
Furnishing and Equipment
Household Operation

Figure 2

TABLE 2. AVERAGE PER CAPITA EXPENDITURES, MAJOR GOODS AND SERVICES BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							$						
All Classes	528[a]	486	124	133	239	64	97	112	366	107	20	29	42
	617	583	135	159	263	68	94	139	432	132	21	33	64
	822	720	179	230	333	81	101	162	575	182	28	36	98
Family Life Cycle													
Unattached individuals, under 45	910	914	233	165	456	128	147	326	893	271	49	72	98
	1,052	1,241	245	222	454	116	131	351	889	324	64	76	138
	1,339	1,515	347	347	554	146	202	431	1,081	469	79	68	208
Unattached individuals, 45-64	819	991	214	162	292	106	131	224	452	176	39	13	58
	912	1,123	236	131	272	118	133	269	599	197	40	1	65
	1,324	1,439	280	260	379	127	146	363	597	219	51	6	128
Unattached individuals, 65 and over	606	833	145	55	130	55	137	67	119	61	24	1	31
	744	995	179	106	164	80	87	106	145	97	28	0	66
	951	1,240	215	145	229	81	121	104	224	184	39	2	69
Married couples, head under 45 without children	733	806	176	295	388	108	124	217	798	216	34	45	74
	816	907	188	294	384	98	123	253	779	278	41	54	123
	1,056	1,108	231	465	509	114	137	266	1,048	346	46	53	195
Married couples, head under 45 with children	447	413	112	130	197	50	80	88	286	85	15	22	35
	526	504	127	154	221	53	77	106	361	111	15	24	54
	687	622	167	219	287	66	83	122	468	149	21	29	87
Married couples, head 45-64 without children	661	547	139	156	320	88	130	151	519	124	24	47	52
	752	660	151	189	331	96	130	196	621	149	26	51	56
	962	712	181	249	408	108	120	213	840	209	32	48	98
Married couples, head 45-64 with children	485	381	98	111	232	57	86	85	304	100	16	36	26
	556	338	93	140	265	59	92	104	369	103	15	42	55
	758	515	132	187	322	71	99	118	458	153	22	46	72

— continued —

TABLE 2. AVERAGE PER CAPITA EXPENDITURES, MAJOR GOODS AND SERVICES BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974 (Continued)

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							$						
Married couples, head	558	538	124	117	170	58	142	84	288	97	23	13	30
65 or over	647	632	135	128	189	66	119	121	281	104	23	7	49
	781	682	165	153	217	76	97	110	437	114	28	7	39
All other families	497	421	116	100	240	61	93	100	331	90	17	30	49
	584	524	124	217	263	67	83	120	371	113	18	35	68
	777	634	174	183	327	75	86	161	525	161	24	38	105
Family Income Quintiles													
First	491	519	101	64	136	47	91	77	158	48	17	21	26
	569	626	112	74	141	53	64	104	193	80	20	27	33
	762	725	151	116	187	63	78	122	221	107	23	22	52
Second	489	443	102	89	184	54	89	108	304	76	17	17	37
	582	540	117	105	197	62	84	138	310	99	21	18	59
	772	688	167	204	266	74	95	155	485	146	27	30	88
Third	484	426	111	107	191	56	85	95	317	81	15	21	33
	584	562	119	148	239	63	85	132	425	122	17	27	70
	785	660	165	207	293	77	94	158	528	166	26	26	91
Fourth	532	461	120	144	250	67	95	116	398	111	19	25	45
	611	558	133	174	265	67	99	134	472	139	19	31	66
	829	716	170	242	346	81	102	163	633	188	26	29	105
Fifth	608	582	173	205	353	82	119	142	508	170	26	53	57
	695	638	173	228	364	85	115	163	585	179	26	54	74
	905	789	218	305	461	97	120	188	777	247	33	61	125

— continued —

TABLE 2. AVERAGE PER CAPITA EXPENDITURES, MAJOR GOODS AND SERVICES BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974 (Concluded)

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							$						
Tenure Class													
Homeowners with mortgage	484	461	107	135	228	58	92	91	341	104	17	30	36
	582	567	129	173	264	64	95	114	446	122	18	34	61
	754	723	165	238	331	75	96	133	562	178	24	42	88
Homeowners without mortgage	570	414	145	127	263	66	111	98	396	112	21	35	45
	627	418	126	154	265	70	105	130	450	122	18	34	52
	845	542	169	194	320	79	104	133	607	172	26	37	88
Tenants, regular	544	533	134	125	238	68	96	131	367	106	22	25	43
	641	659	147	145	265	73	90	162	417	143	25	31	73
	843	741	195	220	345	87	102	194	565	191	32	29	109
Other	597	536	115	190	255	70	104	157	429	112	21	36	54
	575	648	125	191	248	65	83	163	428	151	20	47	58
	872	839	167	324	314	80	99	219	622	176	28	32	127
Age of head													
under 25	593	569	153	158	324	76	90	163	609	152	20	53	61
	667	747	181	197	327	70	101	201	666	239	27	74	91
	877	855	234	294	404	87	106	260	778	275	32	60	138
25-44	495	472	124	142	224	59	87	110	351	103	18	25	40
	582	577	137	167	251	62	82	130	411	133	20	29	64
	756	712	181	250	323	74	92	149	551	182	26	33	102
45-64	567	471	119	127	271	71	105	119	388	112	21	38	40
	658	545	126	155	294	78	108	152	486	127	21	43	62
	875	654	163	207	362	89	109	174	623	178	28	44	94
65 and over	566	613	129	95	168	60	142	78	247	83	24	11	47
	659	713	143	113	183	69	106	112	244	94	23	4	61
	827	788	174	145	225	78	104	116	383	134	31	7	65

[a]The first line of figures is for 1969, the second for 1972 and the third for 1974.

Source: See Table 1.

percent, furnishing and equipment 6 (5) percent and 21 (23) percent, shared among recreation, household operation, smoking and alcoholic beverages, medical and health care, miscellaneous expenses, personal care, education and reading. The remaining 13 (8) percent can be considered as average family savings (Figure 1).

Life Cycle

Data in Table 3 indicate a close relationship between the family life cycle and expenditure pattern. There are two main changes in the distribution of income after taxes with respect to family composition and age of head. First, children were present in spending units that devoted larger shares of income to food, clothing and medical and health care. Second, as the age of the head increased from less than 45 to 65 and over, the portion of income after taxes attributed to smoking and alcoholic beverages, travel and transportation, recreation and education tended to decrease while that for food, shelter and medical and health care tended to increase.

Income Quintile

As expected, consumption expenditures differed greatly among low, medium and high income groups. The high income group, i.e., the fifth income quintile, allocated a much smaller proportion of its income, 16 (16) percent after taxes, to food than did the first income quintile, 32 (33) percent.

A similar relationship existed for shelter, household operation, personal care, medical and health care and smoking and alcoholic beverages. Clothing, furnishing and equipment, travel and transportation were much more important to the fifth quintile than to the first.

Tenure Class

When the same sample of families and unattached individuals is reclassified by tenure class, there are few variations in income shares. While consumers in the other tenant class spent 19 (19) percent of their income after taxes on shelter, homeowners without mortgages spent only 13 (15) percent. A difference also existed in the proportion of income devoted to smoking and alcoholic beverages and miscellaneous expenses between homeowners with or without mortgages and regular and other tenants.

Age of Head

The major differences in income allocations to goods and services between age groups are in Table 3. Expenditure on food and medical and health care took an increasingly large share of income as the age of the household head increased. Spending units whose head is over 65 devoted the smallest share to furnishing and equipment, clothing, smoking and alcoholic beverages, travel and transportation, recreation and education. Except for food, shelter, personal care, medical and health care and reading, no spending unit devoted as large a share of his income after taxes on goods and services than those families whose head is 25 and under.

The classification of families and unattached individuals by socio-economic characteristics revealed that, except for furnishing and equipment, recreation and miscellaneous expenses, shares of income after taxes for most goods and services were generally smaller in 1974 than in 1969 (Figure 1). For example, the proportion of income allocated to essential goods such as food, shelter and clothing decreased 3 percent (from 49 to 46 percent). This might indicate a slight improvement in the consumer's financial condition, especially since from 1969 to 1974 the relative increase in prices indicated by the Consumer Price Index was considerably higher for food, and comparable for housing and clothing and most other goods and services (Statistics Canada, *Price and Price Indexes*).

SUMMARY AND CONCLUSIONS

From 1969 to 1974 average family income after taxes in Canada increased 55 percent to \$12,044 while total current consumption increased 48 percent to \$10,536. Family size, on the other hand, remained fairly constant at approximately three members a family. There were substantial variations in these averages among and within sample partitions. Some examples follow:

- Married couples with children generally had higher incomes and total current consumption than couples without children. Unattached individuals' income and total current consumption reached a maximum before 45 years of age.

- Although total current consumption per family closely followed income after taxes, total current consumption of those in the first and second quintiles exceeded income per family while the opposite was true for those in all other income brackets.

- According to tenure class, average family income and total current consumption of homeowners with or without mortgages were much higher than for regular and other tenants.

TABLE 3. EXPENDITURE SHARES OF INCOME AFTER TAXES[a] BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							percent						
All Classes	21[b]	19	5	5	9	3	4	4	14	4	1	1	2
	20	19	4	5	9	2	3	5	14	4	1	1	2
	20	18	4	6	8	2	3	4	14	5	1	1	2
Family Life Cycle													
Unattached individuals, under 45	19	19	5	4	10	3	3	7	9	6	1	2	2
	18	22	4	4	8	2	2	6	15	6	1	1	2
	19	22	5	5	8	2	3	6	16	7	1	1	3
Unattached individuals, 45-64	20	25	5	4	7	3	3	6	11	4	1	0	1
	20	24	5	3	6	3	3	6	13	4	1	0	1
	19	21	4	4	6	2	2	5	9	3	1	0	2
Unattached individuals, 65 and over	25	34	6	2	5	2	6	3	5	3	1	0	1
	25	34	6	4	6	3	3	4	5	3	1	0	2
	24	32	6	4	6	2	3	3	6	5	1	0	2
Married couples, head under 45 without children	16	18	4	7	9	2	3	5	18	5	1	1	2
	16	18	4	6	8	2	2	5	15	5	1	1	2
	17	18	4	7	8	2	2	4	17	5	1	1	3
Married couples, head under 45 with children	22	20	6	6	10	2	4	4	14	4	1	1	2
	21	20	5	6	9	2	3	4	15	5	1	1	2
	21	19	5	7	9	2	3	4	14	5	1	1	3
Married couples, head 45-64 without children	19	16	4	4	9	3	4	4	15	4	1	1	2
	18	16	4	5	8	2	3	5	15	4	1	1	1
	18	14	4	5	8	2	2	4	16	4	1	1	2
Married couples, head 45-64 with children	22	17	5	5	11	3	4	4	14	5	1	2	1
	21	14	4	5	10	2	3	4	14	4	1	2	2
	22	15	4	6	9	2	3	4	13	5	1	1	2

— continued —

TABLE 3. EXPENDITURE SHARES OF INCOME AFTER TAXES[a] BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974 (Continued)

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							percent						
Married couples, head 65 or over	22	21	5	5	7	2	6	3	11	4	1	1	1
	21	21	5	4	7	2	4	4	9	3	1	0	2
	22	20	5	4	6	2	3	3	13	3	1	0	1
All other families	22	18	5	4	11	3	4	4	14	4	1	1	2
	21	19	4	5	9	2	3	4	13	4	1	1	2
	21	17	5	5	9	2	2	4	14	4	1	1	3
Family Income Quintiles													
First	33	35	7	4	9	3	6	5	11	3	1	1	2
	30	34	6	4	8	3	3	6	10	4	1	1	2
	32	30	6	5	8	3	3	5	9	5	1	1	2
Second	25	23	5	5	9	3	5	6	16	4	1	1	2
	24	23	5	4	8	3	4	6	13	4	1	1	3
	24	22	5	6	8	2	3	5	15	5	1	1	3
Third	23	20	5	5	9	3	4	5	15	4	1	1	2
	21	20	4	5	9	2	3	5	15	4	1	1	3
	22	19	5	6	8	2	3	5	15	5	1	1	3
Fourth	21	18	5	6	10	3	4	5	15	4	1	1	2
	19	18	4	6	8	2	3	4	15	4	1	1	2
	20	17	4	6	8	2	2	4	15	4	1	1	3
Fifth	16	15	5	5	9	2	3	4	13	5	1	1	2
	16	15	4	5	9	2	3	4	14	4	1	1	2
	16	14	4	5	8	2	2	3	14	4	1	1	2

— continued —

TABLE 3. EXPENDITURE SHARES OF INCOME AFTER TAXES[a] BY SOCIO-ECONOMIC CHARACTERISTICS, 1969, 1972 AND 1974 (Concluded)

Socio-economic Characteristic	Food	Shelter	Household Operation	Furnishing and Equipment	Clothing	Personal Care	Medical and Health Care	Smoking and Alcoholic Beverages	Travel and Transportation	Recreation	Reading	Education	Miscellaneous Expenses
							percent						
Tenure Class													
Homeowners with mortgage	20	19	4	6	9	2	4	4	14	4	1	1	2
	19	19	4	6	9	2	3	4	15	4	1	1	2
	19	18	4	6	8	2	2	3	14	5	1	1	2
Homeowners without mortgage	20	15	5	5	9	2	4	4	14	4	1	1	2
	20	13	4	5	8	2	3	4	14	4	1	1	2
	21	13	4	5	8	2	3	3	15	4	1	1	2
Tenants, regular	22	21	5	5	9	3	4	5	15	4	1	1	2
	21	21	5	5	9	2	3	5	13	5	1	1	2
	22	19	5	6	9	2	3	5	14	5	1	1	3
Other	22	19	4	7	9	3	4	6	16	4	1	1	2
	20	20	4	6	8	2	3	5	13	5	1	1	2
	20	19	4	7	7	2	2	5	14	4	1	1	3
Age of head													
under 25	20	20	5	5	11	3	3	6	21	5	1	2	2
	20	22	5	6	10	2	3	6	20	7	1	2	3
	20	19	5	7	9	2	2	6	18	6	1	1	3
25-44	21	20	5	6	9	3	4	5	15	4	1	1	2
	20	20	5	6	9	2	3	5	14	5	1	1	2
	20	19	5	7	9	2	2	4	15	5	1	1	3
45-64	20	17	4	5	10	3	4	4	14	4	1	1	1
	20	16	4	5	9	2	3	5	14	4	1	1	2
	20	15	4	5	8	2	3	4	14	4	1	1	2
65 and over	22	24	5	4	7	2	6	3	10	3	1	0	2
	22	24	5	4	6	2	4	4	8	3	1	0	2
	23	22	5	4	6	2	3	3	11	4	1	0	2

[a]Totals do not add up to 100 percent; the difference can be considered as savings. See Figure 1.
[b]The first line of figures is for 1969, the second for 1972 and the third for 1974.

Source: See Table 1.

– Average income after taxes and total current consumption rose as the age of head increased until consumers reach 65; then they dropped more than 50 percent.

In 1974 the Canadian consumer spent 66 percent of his income on food, shelter, travel and transportation, clothing and furnishing and equipment and 21 percent on other goods and services. The remaining 13 percent can be considered as savings. Compared with those of 1969 these figures indicate a substantial drop in the share of income attributed to shelter, clothing and medical and health care. Other commodity groups remained fairly stable and savings increased nearly 5 percent (Figure 1). This income sharing pattern was also affected by the socio-economic characteristics of the families.

– In life cycle groups with children, a larger share of income was spent on food, clothing and medical and health care than was spent in the other groups.

– The distribution of income shares among commodity groups differed considerably by income level. While the proportion of income devoted to food, shelter, household operation, personal care, medical and health care and smoking and alcoholic beverages tended to decrease as income increased, that attributed to clothing, furnishing and equipment and travel and transportation tended to increase.

– Except for shelter, income shares varied little by tenure class; spending units in the other tenant class allocated the largest share of their income to this essential commodity.

– Income shares for food and medical and health care rose as the age of the head increased, while shares allocated to furnishing and equipment, clothing, smoking and alcoholic beverages, travel and transportation, recreation and education decreased.

From 1969 to 1974 spending units in all classes recorded an increase in nominal income after taxes of 55 percent and in total current consumption of 48 percent. The proportion of income attributed to essential goods and services such as food, shelter and clothing decreased while that allocated to furnishing and equipment, recreation and miscellaneous expenses increased. The classification of families by socio-economic characteristics, however, revealed that unattached individuals over 65, as well as families in the first and second income brackets, the regular tenants and families whose head was less than 25 and 25 to 44, spent more on essential goods and services and less on luxury-type items.

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RECENT DEVELOPMENTS IN AGRICULTURAL PROGRAMS AND POLICIES

DAIRY PROGRAMS AND POLICIES

Note to readers: The following excerpt from Agriculture Canada's news release of April 13, 1978 covers major points of recent federal agricultural program and policy developments. For more complete information on both federal and provincial programs and policies, the series of publications on Federal and Provincial Agriculture Legislation (Programs and Policies) published by Agriculture Canada should be referred to. These publications are updated annually or biannually and are available, while the supply lasts, from Agriculture Canada. Enquiries may be sent to Publication Distribution Unit, Policy and Economics Branch, Agriculture Canada, Ottawa, Ontario, K1A 0C5.

Changes for 1978-79 were effective April 1, as announced by the Minister. The essential points in this program are as follows:

- total market sharing quota, April 1, 1978 to March 31, 1978 is unchanged at 103.7 million hundredweights (45.7 million hectolitres – one hectolitre is equal to 227 pounds of milk);
- federal subsidy remains at $2.66 a hundredweight ($6.04 a hectolitre of milk with 3.604 percent butterfat) paid on industrial milk and cream produced to fill Canadian requirements;
- target price raised to $12.42 a hundredweight ($28.19 a hectolitre) from $12.18 a hundredweight;
- support price for butter raised five cents to $1.27 per pound ($2.80 a kilogram) and support price for skim milk powder raised two cents to 74 cents a pound ($1.63 a kilogram);
- levy on in-quota production reduced to $1.00 a hundredweight ($2.27 a hectolitre) from $1.20 a hundredweight;
- new contingency levy of 20 cents a hundredweight (45 cents a hectolitre) collected on all industrial milk and cream deliveries under quota, refundable to producers not producing in the sleeve or if sleeve production is needed to meet Canadian milk requirements;
- levy of $1.00 a hundredweight ($2.27 a hectolitre) on surplus cream diverted from fluid to industrial use; (The levy is equivalent to 20 cents a hundredweight (45 cents a hectolitre) on all fluid milk shipments. Last year's fluid levy was 25 cents a hundredweight.)
- over-quota levy raised 50 cents to $7.50 a hundredweight ($17.03 a hectolitre);
- while principle of producer responsibility for export disposal of dairy products in excess of domestic requirement is reaffirmed, federal budget for export losses in 1978-79 raised to $24.8 million from $15 million;
- Canadian Dairy Commission budget for product promotion, research and market development raised to $6.5 million from $4 million;
- cheese import quotas reduced to 45 million pounds (20.4 million kilograms) from 50 million pounds;
- market sharing quota period to be altered from the April 1 to March 31 basis to an August 1 to July 31 basis starting next year;
- all provinces will administer quotas in four month allotments to ensure that individual producers do not run out of quota and have incomes reduced for long periods of time;
- Canadian International Development Agency budget to buy skim milk powder for food aid unchanged at $20 million;
- Canadian Dairy Commission investigating new ways to increase domestic industrial use of skim milk powder which could reduce export costs;
- In summary, the federal government has allocated $329 million to the 1978-79 dairy program as follows:

  $260.7 million in producer subsidy payments,
  $ 24.8 million for export assistance,
  $ 17.0 million for carrying charges,
  $ 6.5 million for market promotion and research and
  $ 20.0 million for international food aid.

Milk Production Policies

The Canadian Milk Supply Management Committee – made up of representatives of producers and provincial governments and chaired by the CDC (Canadian Dairy

Commission) – has estimated that market requirements for industrial milk in 1978-79 will be 98 million hundredweights (43.2 million hectolitres), the same as in 1977-78. Total market sharing quota is made up of these market requirements plus a 5 percent sleeve. The Milk Supply Management Committee monitors demand during the year and makes adjustments in market sharing quota if necessary.

The provincial boards are responsible for individual quota allocations.

The changes in the quota period (to an August 1 to July 31 basis) and the administration of quotas on a four-month basis are expected to give a more even pattern of production in relation to Canadian requirements and to help ensure that producers do not run out of quota and income for long periods.

The CDC is working with the provinces to develop further programs to even out production throughout the year.

A move was made towards integrating fluid and industrial milk sectors. The Minister has asked the provinces to aim for integration of their fluid and industrial sectors by 1980.

Surplus Disposal

Stocks of skim milk powder held by the CDC on April 1, 1978 were 30 million pounds (13.6 million kilograms), compared with 177.5 million pounds in storage on April 1, 1977 and 282 million pounds in storage on April 1, 1976. All current inventories and a substantial portion of next year's production have been sold.

Butter inventories are somewhat higher than usual – 32 million pounds (14.5 million kilograms) – however, funds are available from last year's dairy program to pay for disposal of excess supplies.

Production of sufficient butterfat to meet Canadian requirements in 1978-79 will again result in a surplus of skim milk powder.

World market prices for skim milk powder have increased during the past year; however, the large surpluses created by other countries have kept prices below normal levels. As a result, there is still a heavy financial burden for Canadian dairy farmers and the federal government has again decided to set limits on producer responsibility for export losses.

It is hoped that the in-quota levy will be sufficient to cover export losses because this would be consistent with the principle of producer responsibility for export disposal of dairy products in excess of domestic requirements. However, for the 1978-79 dairy year, federal funds will be used to finance additional export costs if necessary and a budget of $24.8 million has been set aside for this purpose. In 1977-78, the government committed $15 million for export costs; however, through careful management and marketing the CDC spent substantially less than the amount budgeted.

The special contingency levy will cover the disposal costs for any in-sleeve production that is surplus to Canadian requirements. However, no producer will have to pay for disposal of sleeve production of another producer and no province will have to pay for sleeve production in another province. The contingency levy will be refunded to the individual producer at the end of the dairy year if he has not produced in the sleeve or if production into the sleeve is needed to meet Canadian requirements.

The CDC will be continuing the butterfat exchange program in 1978-79 and developing new markets for whole milk powder and evaporated milk.

A PERSPECTIVE ON DAIRY POLICY

The following was also taken from Agriculture Canada's news release of April 13, 1978.

The dairy industry contributes almost $2 billion annually to the Canadian economy. Canadian farmers produce about 95 percent of all dairy products consumed by Canadians. In 1977 payments to dairy farmers for milk and cream accounted for about 17 percent of total farm cash receipts.

Milk in Canada is divided between two markets – fluid milk for drinking and industrial milk for manufacturing into butter, cheese, ice cream, skim milk powder and other dairy products. Fluid milk production and sales are under provincial jurisdiction. The federal government plays a large role in coordinating and supporting industrial milk production across the country.

The goal of the federal dairy policy is to provide efficient producers of milk and cream with the opportunity to obtain a fair return for their labor and investment and to provide consumers of dairy products with a continuous and adequate supply of high quality dairy products.

How Milk Production Quotas Are Set

The key to the federal dairy program is effective supply management.

The Canadian Milk Supply Management Committee has the responsibility of determining milk requirements and establishing market sharing quotas to bring forward this volume. This committee is made up of representatives of the provincial milk and cream producer boards, the provincial governments and the CDC (Canadian Dairy Commission) which chairs the committee.

The committee estimates the total demand for industrial milk and cream. For 1978-79 the demand is estimated at 98 million hundredweights (43.2 million hectolitres).

Total market sharing quota is then set to bring forward the milk and cream production needed to meet this demand. It is difficult for farmers to produce exactly the amount required to meet the estimated demand. Moreover, there are always some producers leaving the industry and there is normally a time lag before their quotas are assigned to other producers. Accordingly, a sleeve or tolerance zone for production is used to ensure that producers as a whole are able to produce the full amount of domestic requirements. The Canadian Milk Supply Management Committee has determined that a 5 percent sleeve is necessary to achieve the desired production level. Total market sharing quota is therefore 5 percent higher than the estimated requirements, plus a small amount of quota protected for some provinces. Thus the total quota for 1978-79 is 103.7 million hundredweights (45.7 million hectolitres).

Producers receive their individual quotas (including the 5 percent sleeve) from their provincial milk and cream agencies.

How Producer Prices Are Determined

In April, 1975 the federal government established a formula for setting base returns to farmers for industrial milk and cream.

This returns adjustment formula is used by the CDC in determining the target returns farmers are to receive. It is based on farmers' average cash production costs and the consumer price index (used as a measure of changes in the value of a farmer's labor). In setting the level of target returns, judgement factors are also included.

Dairy farmers do not receive the full target returns. Levies, transportation costs, and provincial assessments for administration and advertising are deducted before a producer receives his money.

How the Dairy Program Affects Retail Prices

Most of the target returns are paid to farmers by dairy manufacturers – creameries, cheese factories and other processors. However, in order to reduce the price of dairy products to consumers, the federal government pays part of the cost of producing industrial milk. This is paid as a direct subsidy to farmers by the CDC. This year's subsidy is $2.66 a hundredweight ($6.04 a hectolitre), the same amount as in the past three years.

The amount that dairy manufacturers pay to farmers for industrial milk and cream is indirectly determined by the support prices for butter and skim milk powder set by the CDC.

This year's support prices are $1.27 a pound for butter ($2.80 a kilogram) and 74 cents a pound for skim milk powder ($1.63 a kilogram). In effect, these support prices are the floor price for these commodities in Canada. Wholesalers can buy them from domestic manufacturers at these prices or above. When the wholesale and retail trades have purchased all the butter and skim milk powder they require, the rest is bought by the CDC at the support prices.

The support price for butter has risen by five cents a pound this year, so the retail price will go up at least this amount. The rise in skim milk powder prices will be at least two cents a pound. In addition, the recent removal of the federal consumer subsidy on instantized skim milk powder will result in a further price increase of at least 34 cents.

Some New Aspects in the 1978-79 Program

The contingency levy of 20 cents a hundredweight (45 cents a hectolitre) is new this year.

An in-quota levy of $1.00 a hundredweight ($2.27 a hectolitre) is being collected on all deliveries within quota. This amount should pay for disposing of surplus milk products made from milk delivered to meet Canadian requirements. Over-quota deliveries are subject to a levy of $7.50 a hundredweight ($17.03 a hectolitre) and this amount covers the cost of disposing of surplus products produced from over-quota milk and cream.

This leaves the problem of milk delivered within quota but surplus to the estimated demand, i.e., in the 5-percent sleeve. Some producers and provinces will not

use all of their market sharing quota and may not produce any milk in the sleeve. However, others may produce their total quota including the sleeve and if this amount is not needed for domestic requirements, the cost of disposing of the surplus will be met from the contingency levy.

No producer will have to pay for the excess production of another producer and no province will have to pay for sleeve production in another province. If a producer does not produce in the sleeve, he will have the contingency levy returned to him at the end of the dairy year. Similarly, if his province as a whole has not produced in the sleeve, his contingency levy will be returned. And if domestic requirements exceed the estimates and the sleeve production can be used in Canada, the levy will be refunded. Should any portion of the sleeve production not be needed to meet Canadian requirements, the contingency levy will be used to finance the disposal of the associated surplus products.

Another new feature is the change in the quota period. The peak milk production period is normally the early summer months when dairy cattle are put on pasture. In the past, some farmers have used too much of their quota in the summer months and run short of quota the following winter. By starting the quota period in the fall and ending it soon after the flush summer season, farmers are less likely to overproduce early in the quota period. Also, they will be able to gear their summer production to the amount of quota they have left.

Four-month quota allotments will also assist farmers in evening out production and will help them from running out of quota and income for a substantial period of time.

During the 1977-78 dairy year, the CDC began a butterfat exchange program. Under this program, whole milk powder, evaporated milk or other dairy products containing butterfat are exported and an equivalent amount of butterfat is imported into Canada in the form of butter.

Why import butter when we have enough in Canada? The world market for products containing butterfat is developing at the same time that skim milk powder prices are remaining low. By exporting whole milk products and importing butter, the CDC cuts down on the amount of surplus skim milk powder produced in Canada, thus cutting down on the expense of disposing of this surplus product at low world prices.

The butterfat exchange program will be continued in 1978-79 and will continue to reduce the export cost of surplus milk solids.

AN UPDATE OF OTHER FEDERAL AGRICULTURAL POLICIES AND PROGRAMS

The following briefs on policy and program items are provided as an aid to readers who regularly check for such developments.

- Beef and veal import controls were announced in March 1978. An ongoing procedure to control imports of beef and veal using quotas has been arranged under the Export and Imports Permits Act. This relates back to the average levels of between 1971 and 1975. The trade in live cattle remains as it was.
- New regulations designed to eradicate brucellosis from Canadian cattle herds came into effect on April 1, 1978.
- Waterfowl crop damage funds were increased to $2.8 million in March 1978, to reduce farmers' crop losses due to migratory waterfowl.

Under the Agricultural Stabilization Act it was announced in March 1978 that there would be payments for the production of sweet cherries and B.C. apricots.

Forage Transportation Assistance was announced in March for Alberta and Saskatchewan. All eligible forage purchased and transported between July 1, 1977 and June 1, 1978 may receive assistance. The deadline is June 1, 1978. Provincial officers of departments of agriculture would have details.

- Amendments were proposed in March 1978 to the Farm Credit Act to increase the FCC's capital from $100 million to $150 million and to raise lending limits to $200,000. Loan limits are presently $150,000 for persons under 35 years of age and $100,000 for those over 35.
- A new experimental farm was announced for eastern New Brunswick.
- An announcement was made in March to upgrade the Prince Rupert federal government grain terminal to the extent of $11.5 million, including a new dock, greater ship loading capacity and expanded cleaning facilities.
- A federal-provincial agreement for Quebec feed freight adjustments was announced jointly by the two

THE 1978-79 DAIRY PROGRAM IN RELATION TO OTHER YEARS

	1975-76	1976-77	1977-78	1978-79
Total market sharing quota (hundredweights of milk)	\$127.9 million[a] \$121.6 million[b]	\$100.5 million	\$105.6 million[c] \$103.7 million[d]	\$103.7 million
Target returns (per hundredweight)	\$11.02	\$11.45	\$11.86[c] \$12.18[e]	\$12.42
Direct subsidy (per hundredweight)	\$ 2.66	\$ 2.66	\$ 2.66	\$ 2.66
Butter support price (per pound)	\$ 1.03	\$ 1.08	\$ 1.18[c] \$ 1.22[e]	\$ 1.27
Skim milk powder support price (per pound)	\$ .64	\$ .68	\$ .70[c] \$ .72[e]	\$ .74
In-quota levy, including sleeve (per hundredweight)	\$ .45[f] \$ .65[g]	\$ 1.35[h]	\$ 1.20	\$ 1.00[i]
Over-quota levy (per hundredweight)	none	\$ 8.60	\$ 7.00	\$ 7.50
Fluid levy (per hundredweight)	none	none	\$ .25	\$ .20
Total federal allocations	\$275 million	\$277 million	\$477 million	\$329 million

[a] As of April 1, 1975.
[b] As of July 1, 1975.
[c] Announced April 4, 1977.
[d] Adjusted by Canadian Milk Supply Management Committee July 1, 1977.
[e] Increases made under returns adjustment formula January 1, 1978.
[f] Established April 1, 1975.
[g] Adjusted July 1, 1975.
[h] In 1976-77 the levy collected on in-sleeve production was \$8.60.
[i] The special 20-cent contingency levy will cover any extra costs for sleeve production disposal.

ministers of agriculture in February 1978, whereby \$33.5 million will be used to carry out four programs to assist Quebec producers in improving self sufficiency in feed grains. Farmers wishing to apply should contact the provincial offices of their department of agriculture.

– A cow-calf payment of \$26 million was announced in February 1978, under the cow-calf stabilization program, for beef producers who registered for assistance under the program in the spring of 1977.

– A Newfoundland small farm agreement was signed by both ministers of agriculture in February 1978. The program is for about \$100,000 and will be effective until March 31, 1979.

A small farm agreement was extended in January 1978, between New Brunswick and Agriculture Canada, to March 1979 for about \$270,000 for 1978-79.

A small farm agreement with Prince Edward Island was extended in December 1977 to March 1979 for about \$200,000.

– Agricultural development plans were announced by Agriculture Canada whereby the federal government was establishing a strategy for agricultural development in order to tap the full potential of the agricultural and food industry. Mr. Whelan set out eight objectives for agricultural development in October 1977, during a debate on the Speech from the Throne. The objectives were as follows:

1. To increase production efficiency in the Canadian agriculture industry;
2. To ensure that agricultural resources are devoted to commodities with the best market potential;
3. To help low-income farm families to make a better living in agriculture;
4. To conserve and improve natural agricultural resources;
5. To increase efficiency in the marketing system;
6. To protect farmers against income instability;

7. To provide longer-term protection against foreign competition for selected commodities;
8. To improve access to foreign markets for Canadian agricultural commodities.

Mr. Whelan stressed that in order to meet these objectives, federal agricultural programs must be co-ordinated among the federal departments and with the provincial governments. Agriculture Canada will take the lead in consultation processes. All current federal development programs will be evaluated.

Agriculture Canada is also taking the lead in meeting with the provinces to discuss separate and joint agricultural development programs. The first priority is to reach an agreement with the provinces to harmonize stabilization programs for commodities that are produced and marketed nationally.

– Feed grain storage programs were announced in October 1977, jointly by the federal Agriculture Minister and the federal Minister of the Canadian Wheat Board to expand feed grain storage in areas short of feed grains. This was to be done in three separate programs with a budget of $28 million over the next five to eight years.

– A new crop development fund of $118,000, contributed by Agriculture Canada, was approved in October 1977 whereby the University of Guelph would do research on peanut production as a cash crop. This was an extension of earlier projects on peanuts that may replace or supplement tobacco crops.

Financial Aid for Canadian Co-operative Implements Limited

The federal government and the governments of Manitoba, Saskatchewan and Alberta provided financial assistance of $15 million to the CCIL (Canadian Co-operative Implements Limited) in April 1978. The federal portion was $8 million while the three provinces provided $7 million among them. The 38 year old co-operative's problems included a large inventory of unsold farm machines – due to a general slump in farm machine sales and risk of going into receivership. Part of the financial aid is interest free and will be recoverable over a period of ten years. Three thousand jobs and co-operative services to a large number of farmers throughout the Prairie Provinces were at stake.

Canada and United States to Expand Joint Agricultural Research.

Canada and the United States have agreed to expand co-operation in agricultural research, including crop forecasting and data supplied by space satellites. Joint arrangements were completed during a visit to Washington by Agriculture Minister Eugene Whelan with U.S. Secretary of Agriculture Bob Bergland.

The new agreement continues work begun under a 1971 agreement.

EVENTS

INTERNATIONAL GREEN CROPS DRYING CONGRESS

The Second International Green Crops Drying Congress will be held at the University of Saskatchewan, Saskatoon, Saskatchewan, Canada, August 20-25, 1978. The congress will promote an exchange of information among researchers, producers, buyers and users of dehydrated green crops. The co-ordinator is Professor Herb Clark of the University of Saskatchewan's Extension Division.

Canada produces more than 287,000 tonnes of dried green crop products annually, making it one of the world's major sources. More than 70 percent of the Canadian production is from Saskatchewan and Alberta, where the industry is almost entirely based on alfalfa. Crops are cut whole at a stage of maturity that ensures maximum nutrient content, dried artificially and processed into pellets or cubes for livestock feed.

Other major producers are France, Spain, Denmark, Britain and the United States, where the industry is based on many other types of green crops besides alfalfa. The chief importer of dried green crop products is Japan, which takes some 80,000 tonnes from Canada each year.

Sixty papers will be presented. Major topics include the demand for quality products and the development of new ones, marketing problems and increasing energy costs.

The congress will also feature a variety of displays, including equipment. Three tours of rural Saskatchewan will give delegates and visitors a first-hand look at the provincial dehydration industry, family farms and some aspects of western Canadian culture.

The first international green crops drying congress was held in 1973 at Oxford University, England.

INTERNATIONAL CEREAL AND BREAD CONGRESS

The Sixth International Cereal and Bread Congress will be held on September 16-22, 1978 in Winnipeg, Manitoba, Canada.

The purpose of the Congress is to expand man's knowledge of using cereal grains to solve the world's food problems. Delegates and speakers from over 50 countries are expected to attend. The meeting is being jointly organized by The Canadian International Grains Institute (CIGI), The American Association of Cereal Chemists (AACC) and The International Association for Cereal Chemistry (ICC).

Registration after May 30 is $120.00. Further information can be obtained from Mrs. Signy Lawson, Canadian International Grains, Institute, 1000-303 Main Street, Winnipeg, Manitoba, Canada, R3C 3G7; phone (204) 985-6559.

PUBLICATIONS

A Directory of Part-time Farming Studies, Vol. 1: North America and Western Europe. A.M. Fuller, J.A. Mage and H.A. Fuller. June 1977. 81 p. *Available from the University of Guelph.*

A Strategy for Food Processing, Distribution and Retailing Sectors. February 1978. 58 p. *Available from Consumer and Corporate Affairs Canada.*

Anti-dumping Tribunal Annual Report. 1977. Bilingual. 120 p. *Available free from the Anti-dumping Tribunal, Place Bell Canada, Ottawa, Ontario, K1A 0G5.*

Are Regional Development Policies Needed? N. Hansen, August, 1976. 23 p. *Available from the International Institute for Applied Systems Analysis.*

The Canadian Rapeseed Industry: The Economic Implication of Crowsnest Rate Changes in Transportation and Tariff Costs. W.H. Furtan, J.G. Nagy, G.G. Storey. February 1978. 105 p. *Available from the University of Saskatchewan.*

The Canadian Wheat Board Annual Report 1976-77. January 31, 1978. 103 p. *Available free from the Canadian Wheat Board, 423 Main Street, Winnipeg, Manitoba, R3C 2P5.*

The Canadian Wheat Board Report to Producers on the 1976-77 Crop Year. 1978. 22 p. *Available free from the Information Department, Canadian Wheat Board, 423 Main Street, Winnipeg, Manitoba.*

Dairy Price Policy: Setting, Problems, Alternatives. Alden C. Manchester. April 1978. 65 p. *Available free from the U.S.D.A., Economics, Statistics and Cooperatives Services, Washington, D.C. 20250.)*

The following four publications are available free, except where noted, from the National Design Council, Department of Industry, Trade and Commerce, 240 Sparks Street, Ottawa, Ontario, K1A 0H5.

> **Good Design Helps Tap World Markets.** October 1972, 5 p. Bilingual.
>
> **Handbook for Market Development.** 59 p. $5.00.
>
> **Product Design Case Study – Cutting a Wider Swath in the Marketplace.** 1976. 4 p. Bilingual.
>
> **Product Design Case Study – Reliable Equipment for Solving Down-to-earth Problems.** 1977. 3 p. Bilingual.

The following five publications are available free from DREE, 414-1175 Douglas St., Victoria, British Columbia and ARDA Branch, B.C. Ministry of Agriculture, Legislative Buildings, Victoria, British Columbia, V8W 2Z7.

> **Canada-British Columbia Subsidiary Agreement on Agriculture and Rural Development.** July 8, 1977. 60 p.
>
> **Co-ordinated Resource Management.** 1978. 6 p.
>
> **Primary Resource Development.** 1978. 6 p.
>
> **Research, Planning, Training and Market Promotion.** 1978. 6 p.
>
> **Support Services and Community Development.** 1978. 6 p.

Economic Impact. 1977. No. 4. Quarterly. *Available for $4.00 a year from the U.S.I.S. Publications Centre, P.O. Box 1011, Postal Station O, Toronto, Ontario, M4A 2N4.*

Environmentally Appropriate Technology Seminar Nov. 30 – Dec. 3, 1976 for the Mid-North of Canada. March 1977. 72 p. *Available from the Canadian Council of Rural Development.*

Feed Grain Supply Security in Quebec and Eastern Ontario. Robert St-Louis, Yvon Proulx, Laval University, Quebec. March 1977. *Available free from the Canadian Livestock Feed Board, Montreal, Quebec.*

Food Policy. November 1977. Vol. 2, No. 4. Quarterly. *Available from the IPC Science and Technology Press Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, England, RH16 3DH.*

Food Policy – Economics Planning and Politics of Food and Agriculture. February 1978. *Available from I.P.C. Science and Technology Press Ltd.*

The Fourth FAO World Food Survey. 1978. *This study may be purchased through Renouf Publishing Co. Ltd., St. Catherine St., West, Montreal, Quebec, H3H 1M7. In*

the United States it may be purchased through UNIPUB, Inc., 345 Park Avenue, S., P.O. Box 433, Murray Hill Station, New York, N.Y. 10016.

GATT – Publications of the General Agreement on Tariffs and Trade. 1977-78. 10 p. *All publications listed in this pamphlet may be purchased from UNIPUB, Inc., P.O. Box 433, Murray Hill Station, New York, N.Y. 10016.*

GATT – What it is, What it Does. October, 1977. 16 p. *Available free from the General Agreement on Tariffs and Trade (GATT) Information Service, Centre William Rappard, rue de Lausanne 154, 1211 Geneva 21, Switzerland.*

Government Regulation Issues and Alternatives 1978. 275 p. *Available from the Ontario Economic Council.*

The IDRC Reports. March 1978. Vol. 7, No. 1. 27 p. Quarterly. *Available free from the International Development Research Centre, Box 8500, Ottawa, Ontario, K1G 3H9.*

The Impact of Free Trade in Canada. R. Dauphin. December 1976. 185 p. *Available from the Economic Council of Canada.*

List of Publications. Spring 1978. 20 p. Bilingual. *Available free from the Department of Industry, Trade and Commerce, Office of Information and Public Relations, Printing and Distribution, 235 Queen St., 2nd Floor East, Ottawa, Ontario, K1A 0H5.*

National Dairy Program, 1977-78. 1977. *Available from the Canadian Dairy Commission.*

Ontario Rural Geography Group Newsletter. Monthly. Annual membership dues (July 1 to June 30) are to be $5.00 for all members except students, who will pay $1.00 May 31, 1978. *Available from O.R.G.G., Department of Geography, University of Guelph, Guelph, Ontario, N1G 2W1.*

Prairie Farm Policy Guide. 1976. 58 p. *Available from the Western Producer, P.O. Box 2500, Saskatoon, Saskatchewan.*

Proceedings, Meat Packers Council of Canada, 58th Annual Meeting. The Queen Elizabeth Hotel, Montreal. Feb. 12-14, 1978. *Available free from the Meat Packers Council of Canada.*

The following reports on Producers' Concensus of Costs and Returns are available from Alberta Agriculture.

Northeast Alberta: Lac La Biche District. March 1978. 19 p.

Northeast Alberta: Provost District. March 1978. 25 p.

South Central Alberta. March 1978. 21 p.

The following five publications on Producers' Consensus Costs and Returns are available from the B.C. Ministry of Agriculture.

Alfalfa Hay Production in the Salmon Arm District. Revised 1977. 7 p.

Corn Silage Production (Bunker Silo Storage) in the Aldergrove-Langley Area. January 1978. 7 p.

Corn Silage Production in the Salmon Arm District. Revised 1977. 6 p.

Silage, Hay and Pasture Production in the South Peace River District. January 1978. 10 p.

Summerfallow, Barley, Oats, Alsike Clover in the Farmington Area. January 1978. 12 p.

Report on Food Consumption and Nutrition. January 20, 1978. 92 p. *Available free from Consumer and Corporate Affairs Canada.*

Report on the Specialty Cheese Industry in Canada. 1978. 28 p. *Available from the Dairy Division, Agriculture Canada, Ottawa, Ontario, K1A 0C5.*

Report by the Tariff Board, Fresh and Processed Fruits and Vegetables. 1977. 468 p. *Available from the Tariff Board.*

Trade and Aid, Proceedings of this Agriculture and Food Marketing Forum. R.M.A. Loyns, Norman J. Beaton, Eds. January 1978. *Available free from the Department of Agricultural Economics, 403 Agriculture Building, University of Manitoba, Winnipeg, Manitoba.*

IN REPLY

Note to Readers: We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we'll try to accommodate you.

When forwarding your "In Reply' or letter, indicate if we may publish your comments in a subsequent issue.

W.R. (Bob) Campbell, Ranch Superintendent, 143-Marlbrook Circle, Northeast, Calgary, Alberta, T2A 2W8 gave the December issue of CFE a full 10 points on the 1–10 scale. This issue had articles on Japan – Canada's leading export market, cow-calf systems for the Maritimes and effective farm management. "We need to expand our agricultural export market so what better place than Japan . . . cow-calf production is of prime importance to me, Canada and the world. We have a continuing need for better management practices. The issue was very useful."

R.M. Plank, Assistant Regional Manager, Farm Credit Corp., P.O. Box 249, Kelowna, British Columbia, B1Y 7N5 wrote to say that he marked the article on Japan – Canada's leading agricultural export market, nine points out of ten. The article, he said, provided detailed information on an important subject and provided policy background. He suggested that articles should be written on Canada's agricultural trade with both the United States and the EEC, similar to this one.

Mr. Plank said that the whole issue was not very useful to him because it could not be used in his everyday work; however, he felt it was "very interesting". He said the report on the symposium on Canada and world food in the December issue has implications for everyone working in agriculture.

R.G. Cochrane, a farmer, Box 39, Strasbourg, Saskatchewan, S0G 4V0 wrote, "the first article on Canada-Japan trade was very useful in that it gave me a better picture of our trade with Japan and of the future. The article on farm management was too general for farming. About the whole issue he said, "As far as keeping in touch with the world situation it was good. I hope to see the publication continue."

Yves Lauzon, a farm management counsellor in Notre-Dame-du-Lac, Québec, wrote to say how useful the December issue was for him. Every day he meets farmers to whom he gives advice on farm management practices and beef production. Our December issue had articles on both subjects and Mr. Lauzon rated them highly. He photocopied the article on cow-calf systems for the Maritime Provinces and distributed copies to the beef producers he advises so that they all could discuss what was said in the article.

Réal Jarret, a farmer from Ange-Gardien, Québec, also found the December issue useful, particularly Jim McKenzie's article on effective farm management. Mr. Jarret underlines the fact that the article surfaced ". . . many of the lessons (he) learned while attending MacDonald College." Mr. Jarret went on to say that it was an article that ". . . many farmers should read."

William Smith, Teaching Assistant and Ph.D. student, Geography Department, McGill University, 805 Sherbrooke St., Montréal, Québec, writing about the October 1977 issue of CFE said that he read the articles on the Canfarm farm record system and on the regional comparison of structural change and resource use in the Canadian farm industry, 1961-1971. He gave the last article full marks. "There is little published work in this area. The whole issue was very useful. I use it for research and teaching purposes."

Marvin Sunstrum, Assistant Professor, Geography, Department of Geography, University of Lethbridge, Alberta read the first and third articles in the October issue. He gave the last article nine points out of ten. He says "the whole issue has above average interest to me as background for lectures in agriculture and economic geography courses."

C.J.N. Gibbs, Director, Policy Development and Planning, Ministry of Agriculture, British Columbia wrote to the author about the third article in the October issue. "I should like to say the statistics you presented were very informative and I should like to ask when you will add an analysis of the 1971-76 period to what you have already completed? As soon as you have a manuscript covering the most recent time period completed, I should appreciate hearing from you." (Editors note: The author replied to Mr. Gibbs; "Thank you for your kind comments on our recent article. We have received several requests to update the statistics and we intend to do so when all the 1976 data have become available and time permits. A copy of the updated statistics will be forwarded to you once they are compiled. Sincerely, Wayne Jones.")

R. Butler, Professor, University of Saskatchewan, Saskatoon, wrote about the article on instability in the world beef market carried in the August 1977 issue of CFE. He said he would give it eight points out of ten. "An excellent over-view of the current beef market".

IN REPLY TO AUTHORS AND EDITORS REGARDING JUNE 1978 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) The Economics of Increasing Crop Productivity in Ontario and Quebec by Tile Drainage Installation
(2) The Energy Demands of Agriculture
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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:
LINEAR		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
AREA		
square inch	x 6.5	square centimetre (cm^2)
square foot	x 0.09	square metre (m^2)
acre	x 0.40	hectare (ha)
VOLUME		
cubic inch	x 16	cubic centimetre (cm^3)
cubic foot	x 28	cubic decimetre (dm^3)
cubic yard	x 0.8	cubic metre (m^3)
fluid ounce	x 28	millilitre (ml)
pint	x 0.57	litre (ℓ)
quart	x 1.1	litre (ℓ)
gallon	x 4.5	litre (ℓ)
WEIGHT		
ounce	x 28	gram (g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (t)
TEMPERATURE		
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius (°C)
PRESSURE		
pounds per square inch	x 6.9	kilopascal (kPa)
POWER		
horsepower	x 746	watt (W)
	x 0.75	kilowatt (kW)
SPEED		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
AGRICULTURE		
gallons per acre	x 11.23	litres per hectare (ℓ/ha)
quarts per acre	x 2.8	litres per hectare (ℓ/ha)
pints per acre	x 1.4	litres per hectare (ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare (ml/ha)
tons per acre	x 2.24	tonnes per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

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VOLUME 13 NUMBER 4 AUGUST 1978

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. EUGENE WHELAN, MINISTER – GAÉTAN LUSSIER, DEPUTY MINISTER

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CANADA'S AGRICULTURAL TRADE — RECENT DEVELOPMENTS AND EXPORT PROSPECTS

Farm exports reached record levels in 1977 despite lower world prices. An increased volume of exports for a number of non-grain commodities was achieved. Several factors are now combining to improve the export outlook for a range of products. Further improvements in productivity will enable farm exports to continue to play a major role in Canadian agriculture.

*J.S. Lohoar**

INTRODUCTION

Agricultural trade issues continue to be of central importance to Canada's agricultural industry. Farm product exports represent approximately 40 percent of total cash farm receipts while food imports have a direct influence on many sectors of the domestic industry. Since the early 1970s, several factors, including instability in commodity prices, fluctuating exchange rates, and concern over global food security, have combined to influence the quantity of agricultural trade and its composition. There have been substantial changes in this period and it is timely to review recent trends in agricultural trade and their implications for the future. Also, as the Multilateral Trade Negotiations approach a conclusion in Geneva, it is possible to consider the prospects for farm exports against the background of the record of the first part of the 1970s.

This article briefly reviews the role of international trade and summarizes and assesses Canada's 1977 trade in farm products in relation to the trade performance since the early 1970s. The factors which influenced Canada's agricultural trade during this period are then evaluated. Against the background of these factors and a review of recent developments affecting trade, the article assesses the prospects for expanding farm exports.

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THE ROLE OF AGRICULTURAL TRADE

In 1977 world exports of agricultural products were estimated to have reached $146 billion, representing approximately 13 percent of total exports. Although agricultural exports represent only a small percentage of world food consumption, they play a central role in equating the demand and supply of farm products. Because of the relatively small proportion of total farm production traded, both the volume and value of agricultural exports are subject to sharp fluctuations.

Although exports represent only a small part of total farm output, trade in farm products is very important to particular countries. In 1976 Canada was the seventh largest exporter of farm products, following the United States, France, Netherlands, Brazil, Australia, and West Germany. West Germany was the leading importer of farm products, with imports valued at over $15 billion. The United States, United Kingdom, Japan, U.S.S.R., Italy, France and the Netherlands all imported more than $5 billion worth of farm products. Trade figures for the European Economic Community (EEC) countries tend to be high, reflecting the movement between member countries of high value products, e.g., livestock, meat and dairy products.

For exporting countries, revenue from farm product sales to overseas markets often represents an important part of economic activity. Agricultural exports have

made a substantial contribution to Canada's trade balance in recent years (Figure 1). The positive agricultural trade balance has assisted in reducing the growing trade deficit in the non-agricultural sector. In addition to helping Canada's international trade balance, the expansion of agricultural exports continues to increase employment in both the farm and non-farm sectors.

The inherent instability of international trade has been accentuated during the 1970s by several factors. Reduced harvests in 1972-73 resulted in sharply higher commodity prices. This was followed by the sudden increase in oil prices which caused a reduced demand for a number of export items, particularly meat and dairy products. This was further complicated by large fluctuations in exchange rates which have had repercussions in many areas of agricultural trade.

Agricultural trade in several countries, including Canada, should remain important. Against the background of current concerns about exports of non-renewable resources, it is probable that exports of renewable resources, such as agricultural, forestry and fishery products, will assume a greater role. It can therefore be expected that, with oil, natural gas and some mineral exports being reduced, agricultural exports will likely be more important if a positive trade balance in Canada is to be maintained.

CANADA'S AGRICULTURAL TRADE PERFORMANCE, 1971-77

Since the early 1970s Canada's agricultural trade has been subject to unusual forces which have influenced the quantity and value of both exports and imports. To place the 1977 trade figures for particular commodities in perspective, it is helpful initially to review the trends in Canada's agricultural trade from 1971 to 1977.

During these years, there were significant changes in the international economic and trade framework which have had a direct impact on Canada's agricultural trade performance. The reduced import demand for many farm products following the increase in oil prices resulted in considerable price variations on world markets. This instability was further increased by fluctuating exchange rates. These conditions forced countries to introduce policy measures to insulate their producers from the full effect of the price changes. As a result, Canada saw the development of protective measures and export incentives by competitors that reduced access to

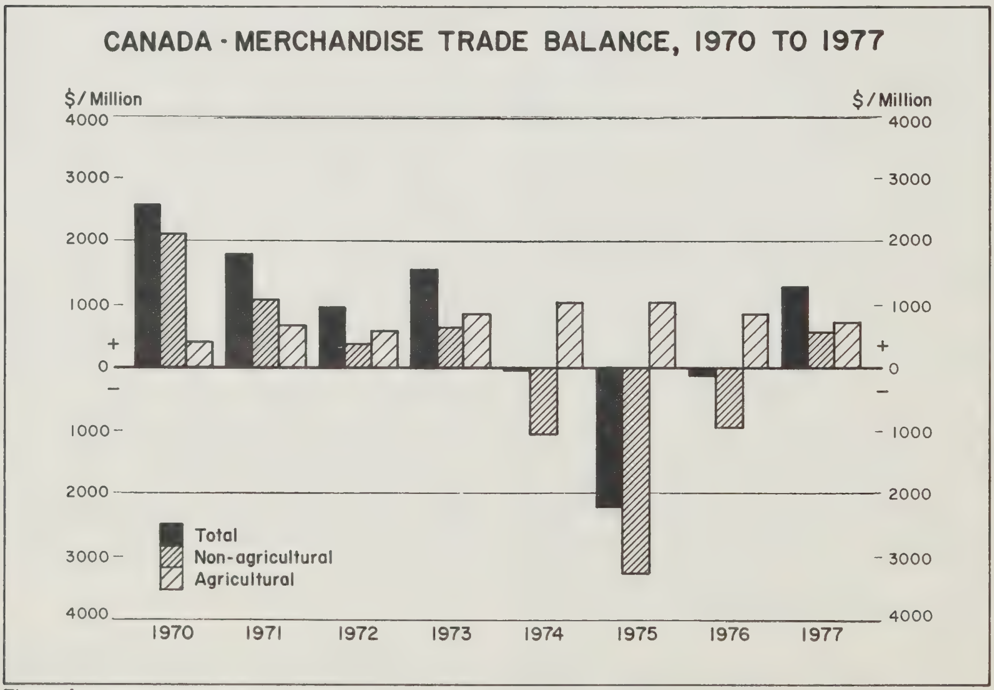


Figure 1

TABLE 1. AGRICULTURAL TRADE BALANCES, CANADA, 1970 TO 1977

Net Trade (Exports less Imports)	Average 1970-72	1973	1974	1975	1976	1977
			$ million			
Total Agricultural Trade	+ 564	+ 841	+1003	+1048	+ 837	+ 710
Supplementary (Competing) Products[1]	+1045	+1465	+1689	+1797	+1774	+2029
Supplementary Products (Excluding Grains)	+ 64	+ 33	− 520	− 575	− 470	− 96
Complementary Products[2]	− 481	− 624	− 686	− 749	− 937	−1319

[1]Supplementary commodities consist of imports similar to or the same as agricultural comodities produced commercially in Canada.
[2]Complementary imports include all agricultural imports other than supplementary, e.g., tropical products and non-storable fruits and vegetables imported during the Canadian "off-season."

a number of its traditional markets and led to the adoption, for specific commodities, of compensatory measures to restrict import access and to protect domestic producers. In addition, the severe price fluctuations on world commodity markets resulted in a high level of uncertainty and instability for Canadian farmers.

During this period, Canada's favorable agricultural trade balance was largely due to the higher level of world prices for grains rather than any improvement in the volume of exports. For when trade in grains is excluded, it is apparent that Canada's trade position within the non-grain sector deteriorated from 1974 to 1976 (Table 1). This situation reflected not only an increased volume of complementary imports (i.e., products which are not produced in Canada, e.g., citrus fruit, bananas, coffee and tea) at higher prices but also the unfavorable trade position for competing temperate products outside the grain area. This can be demonstrated by calculating the trade balance for competing supplementary products, i.e., commodities which can be produced in Canada, but excluding trade in grains. In the early 1970s, these products showed a small trade surplus, but from 1974 to 1976, a deficit of about $500 million annually was incurred (Table 1). A significant improvement, however, took place in 1977; the deficit declined to less than $100 million, reflecting the gains achieved in several non-grain commodity areas (Table 2).

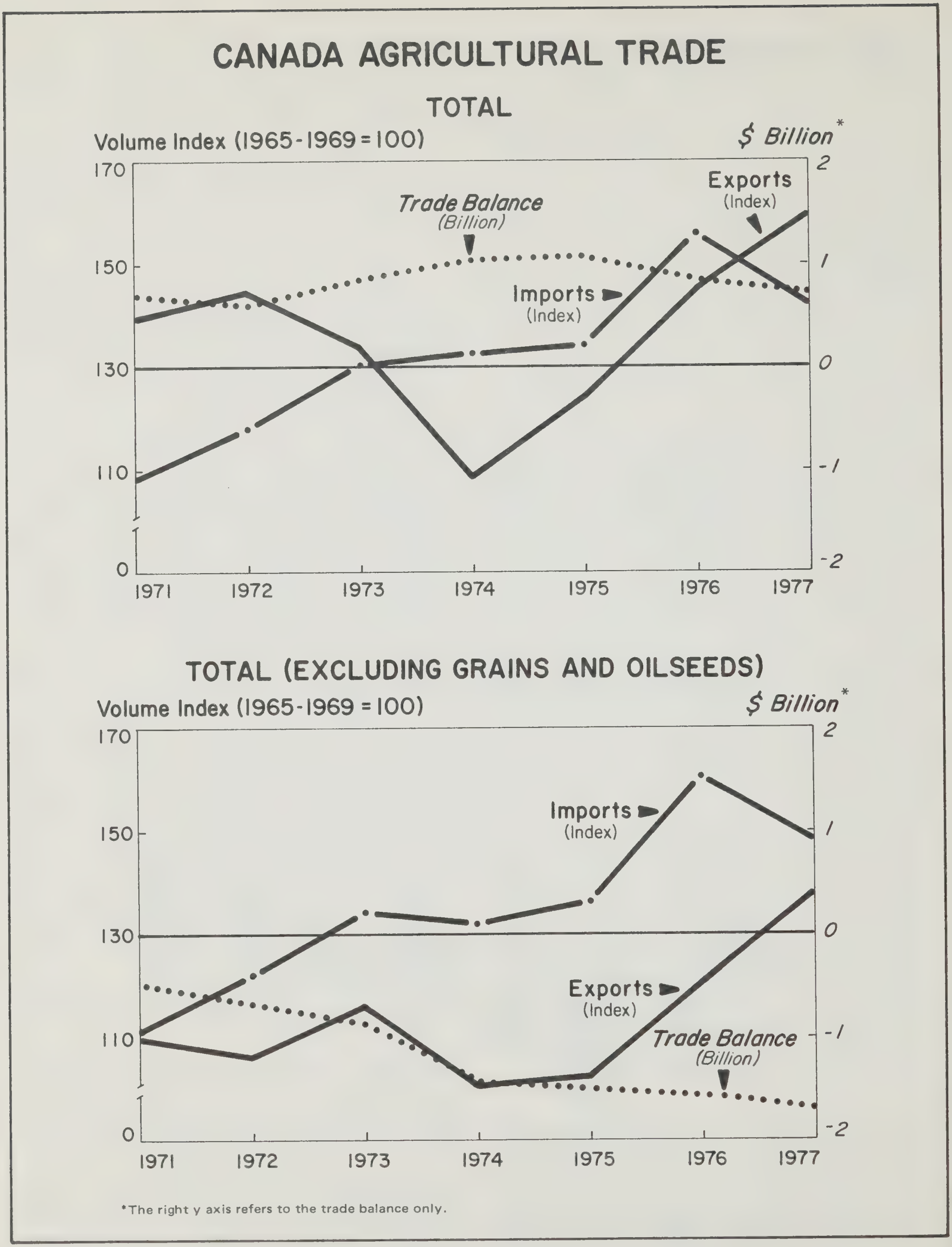
To ensure that the recent substantial price fluctuations in world commodity markets do not obscure the basic trends in Canada's trade performance, a volume index (base 1965-69 = 100) was developed to remove the effect of price fluctuations and permit an examination of trends in the trade volume. The results of this analysis are outlined in Figures 2 to 4. The index of the volume of aggregate agricultural exports was 144 in 1972, i.e., 44 percent above the base period. As a result of the extraordinary developments in world markets for agricultural commodities in the 1972-74 period and the depletion in stocks, the index fell to 108 in 1974. There has been a steady improvement in the index since 1974, however, and by 1977, the index had recovered the ground lost and reached 159 (Figure 2).

In contrast to the index for agricultural exports, the aggregate agricultural import volume index showed a continuous increase in the period 1971-76. In 1972 the aggregate agricultural import volume index was 18 percent above the base period. Consecutive annual increases in the quantities of agricultural products imported into Canada resulted in a volume index of over 155 by 1976. Commodities showing increased quantities of imports during this period included meat, oilseed products, tobacco, fruits and vegetables. In 1977, however, the volume of imports in the majority of commodity sectors decreased (Figures 3-4) and the aggregate index declined significantly to 142 (Figure 2).

HIGHLIGHTS OF CANADA'S AGRICULTURAL TRADE IN 1977[1]

The value of Canada's farm product exports again reached record levels in 1977 and surpassed the $4 billion mark for the first time. Exports were valued at $4,265 million, an increase of 7.5 percent over the 1976

[1]For more detailed information on Canada's trade in agricultural products during 1977, see D.L. Bolton, *Canada's Trade in Agricultural Products, 1975, 1976, and 1977,* Publication No. 78/7, Policy, Planning and Evaluation Branch, Agriculture Canada.


CANADA AGRICULTURAL TRADE
TOTAL
Volume Index (1965-1969 = 100)
$ Billion*
Trade Balance
(Billion)
Exports
(Index)
Imports
(Index)
170
150
130
110
0
2
1
0
-1
-2
1971
1972
1973
1974
1975
1976
1977
TOTAL (EXCLUDING GRAINS AND OILSEEDS)
Volume Index (1965-1969 = 100)
$ Billion*
Imports
(Index)
Exports
(Index)
Trade Balance
(Billion)
170
150
130
110
0
2
1
0
-1
-2
1971
1972
1973
1974
1975
1976
1977
*The right y axis refers to the trade balance only.
Figure 2

total of $3,966 million (Table 2). Imports of agricultural products also increased, largely because of higher prices for plantation crops such as coffee, citrus fruit and other imported fruits and vegetables. The value of farm imports in 1977 was $3,555 million, an increase of 13.6 percent from 1976 when the import bill was $3,129 million. Because of the sharp increase in the prices of several imported items and lower wheat prices, the agricultural trade balance in 1977 declined 15.2 percent to $710 million, compared with $837 million in 1976.

An important feature of the 1977 trade figures was the significant improvement in the volume and value of exports of some non-grain commodities (Table 2). The value of oilseed exports increased 55.8 percent to $441 million, reflecting a recovery in export volume and higher prices. Similarly, the value of oilseed product exports increased very significantly to $102 million, reflecting increased sales of rapeseed oilcake and meal to the EEC and shipments of rapeseed oil as food aid to India.

TABLE 2. SUMMARY OF CANADA'S TRADE IN AGRICULTURAL PRODUCTS, 1976 AND 1977

	1976			1977		
Product	Exports	Imports	Balance	Exports	Imports	Balance
			$ million			
Exports and Supplementary Imports[a]						
Grains	2,365	121	+2,244	2,214	89	+2,125
Grain Products (For Human Use)	202	57	+ 145	206	77	+ 129
Animal Feeds	109	34	+ 75	125	32	+ 93
Oilseeds	283	126	+ 157	441	147	+ 294
Oilseed Products	48	190	− 142	102	226	− 124
Animals, Live	120	89	+ 31	135	30	+ 105
Meats	207	335	− 128	222	295	− 73
Other Animal Products	204	187	+ 17	258	199	+ 59
Dairy Products	61	57	+ 4	92	64	+ 28
Poultry and Eggs	15	60	− 45	21	53	− 32
Vegetables[b]	71	206	− 135	84	261	− 177
Potatoes and Products	46	29	+ 17	33	37	− 4
Fruit[b]	31	178	− 147	44	193	− 149
Seeds for Sowing	21	24	− 3	32	28	+ 4
Maple Products	8	—	+ 8	10	—	+ 10
Sugar	17	275	− 258	42	230	− 188
Tobacco	63	8	+ 55	64	9	+ 55
Other Items	77	198	− 121	102	228	− 126
Total	3,948	2,174	+1,774	4,227	2,198	+2,029
Exports and Complementary Imports[c]						
Vegetables[d]	—	83	− 83	—	99	− 99
Fruit[d]	—	320	− 320	—	394	− 394
Nuts	1	48	− 47	1	63	− 62
Vegetable Fibers	5	76	− 71	7	86	− 79
Plantation Crops	10	406	− 396	28	686	− 658
Other Items	2	22	− 20	2	29	− 27
Total	18	955	− 937	38	1,357	−1,319
Grand Total	3,966	3,129	+ 837	4,265	3,555	+ 710

[a]Supplementary commodities consist of imports similar to or the same as agricultural commodities produced commercially in Canada.
[b]Excludes imports of non-storable items during the Canadian "off-season."
[c]Complementary imports include all agricultural imports other than supplementary.
[d]Includes imports of non-storable items during the Canadian "off-season."

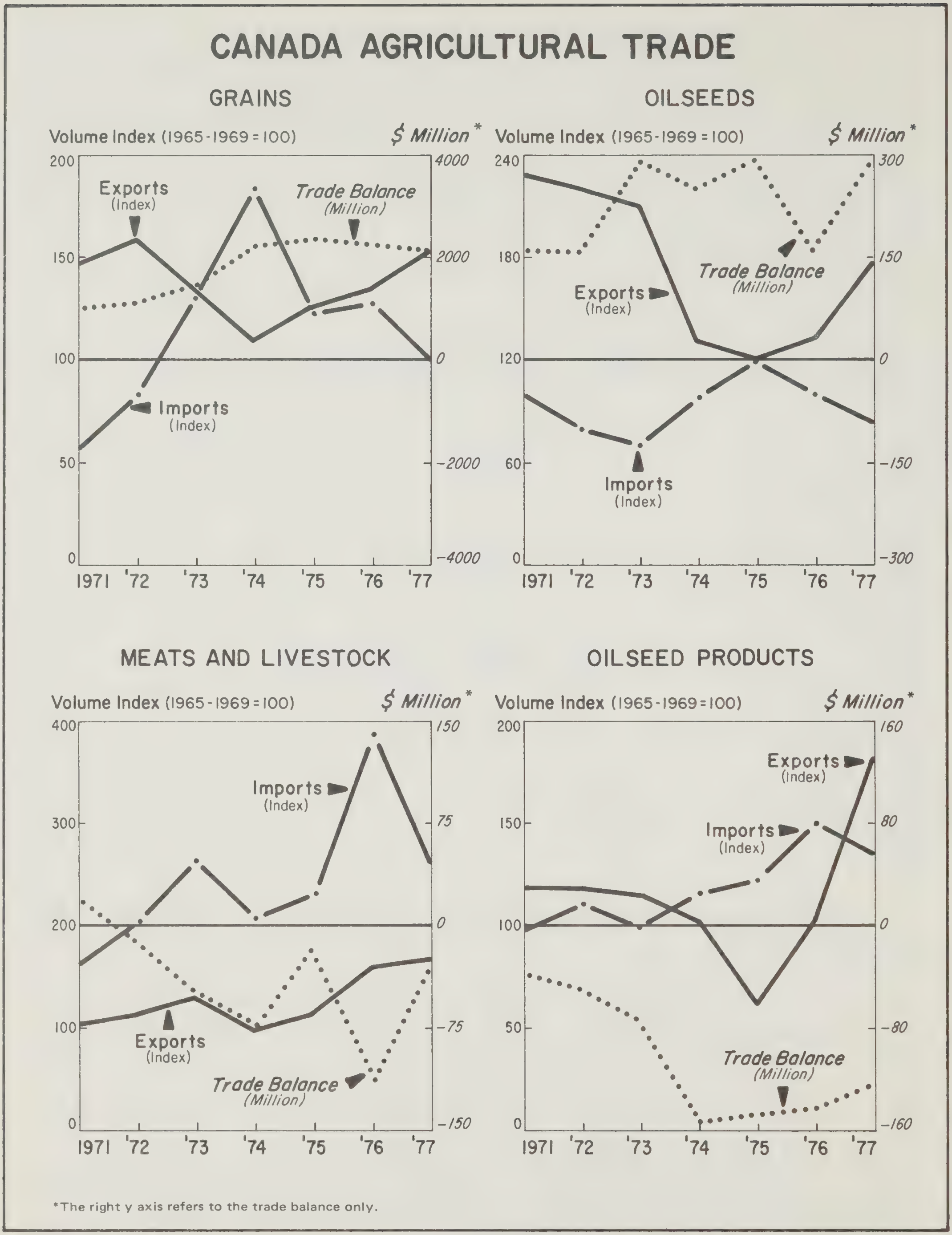

CANADA AGRICULTURAL TRADE
GRAINS
Volume Index (1965-1969 = 100)
$ Million*
200
150
100
50
0
4000
2000
0
-2000
-4000
Exports
(Index)
Trade Balance
(Million)
Imports
(Index)
1971 '72 '73 '74 '75 '76 '77
OILSEEDS
Volume Index (1965-1969 = 100)
$ Million*
240
180
120
60
0
300
150
0
-150
-300
Trade Balance
(Million)
Exports
(Index)
Imports
(Index)
1971 '72 '73 '74 '75 '76 '77
MEATS AND LIVESTOCK
Volume Index (1965-1969 = 100)
$ Million*
400
300
200
100
0
150
75
0
-75
-150
Imports
(Index)
Exports
(Index)
Trade Balance
(Million)
1971 '72 '73 '74 '75 '76 '77
OILSEED PRODUCTS
Volume Index (1965-1969 = 100)
$ Million*
200
150
100
50
0
160
80
0
-80
-160
Exports
(Index)
Imports
(Index)
Trade Balance
(Million)
1971 '72 '73 '74 '75 '76 '77
*The right y axis refers to the trade balance only.

Figure 3

Live cattle exports to the United States increased while the level of beef and veal shipments was generally maintained under the arrangement to regulate the two-way trade in beef and veal between Canada and the United States. Although pork imports in 1977 continued at a high level, $149 million, pork exports (mainly to Japan) reached a record level of 93.8 million pounds, valued at $116 million. This resulted in a reduced trade deficit for pork of $33 million which was a factor contributing to the positive balance in the meat and livestock sector of $32 million, compared with the deficit of $98 million in 1976. Exports of dairy products at $92 million were substantially higher, mainly reflecting increased sales of skim milk powder. The butterfat exchange program operated by the Canadian Dairy Commission (CDC) during part of 1977 also resulted in additional overseas sales of whole milk powder, evaporated milk and other dairy products containing butterfat. Export gains were also achieved in other commodity groups which in previous years had shown some difficulty in maintaining export levels. These include fruits and vegetables, seeds for sowing, maple products and tobacco.

The improved export performance in 1977 is summarized in Table 2. The total trade balance for competitive (supplementary) commodities rose 14.4 percent from $1,774 million in 1976 to $2,029 million, despite a decline in the balance of trade in grains which decreased 5.3 percent, reflecting the lower level of world grain prices, in 1977.

The substantial improvement in exports was not quite sufficient to offset the large increase in the value of imports of products not available in Canada. These complementary imports increased 42.1 percent from $955 million in 1976 to $1,357 million last year. This sizeable increase was mainly the result of sharply higher world prices for imported beverages such as coffee, cocoa and tea, but also of a generally higher level of import prices due to the lower value of the Canadian dollar.

FACTORS AFFECTING CANADA'S AGRICULTURAL TRADE IN RECENT YEARS

Several factors are responsible for the less favorable conditions which have faced Canadian agricultural producers since the early 1970s: general economic conditions, adverse developments in the overseas trading environment, and developments in the domestic industry. These are discussed below in relation to individual commodities and in some cases specific export markets.

General Economic Conditions

Rate of Economic Growth

As in other sectors of the economy, agricultural exports have been adversely affected by the slower pace of economic activity in most developed economies. Moreover, recent improvements in the United States have been less beneficial to agricultural exports than to other exports since the United States is less important as an export outlet for agricultural products than for industrial products. The slow rate of economic growth in many export markets has had a particularly adverse effect on exports of livestock products, e.g., meats and cheese.

Exchange Rate

From 1974 to 1976 agricultural exports faced stiff competition because of the continuing high value of the Canadian dollar in relation to the currencies of most other countries. In recent months, however, the fall in the value of the Canadian currency has reversed this situation somewhat.

Deteriorating Competitive Position

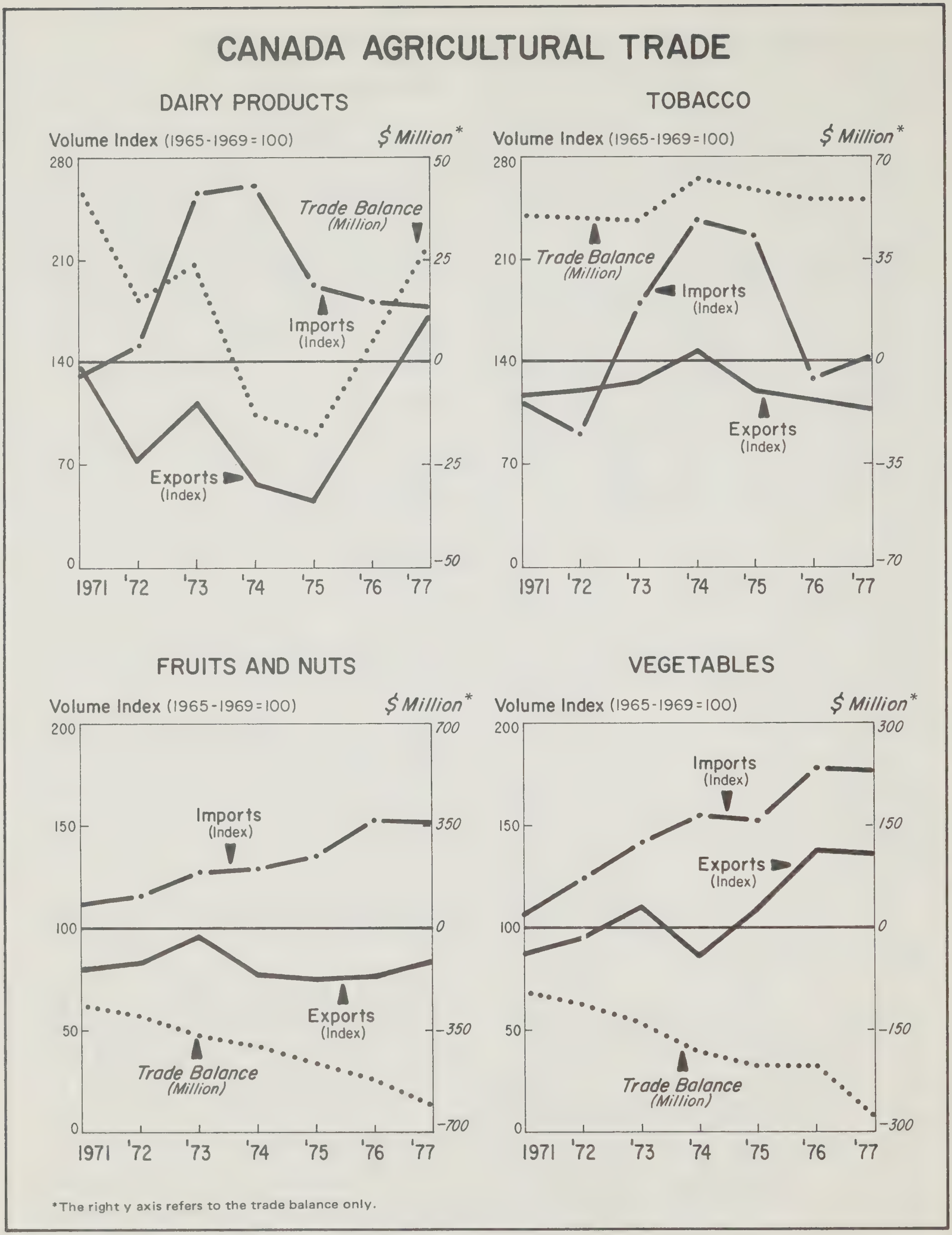
The higher rate of increase in production costs in Canada than in many competing countries, particularly for labor, machinery, and energy, has resulted in some agricultural exports becoming less competitive on world markets – especially where there is a significant labor element in the cost of production, e.g., processed fruits and vegetables. In this context the agricultural industry is facing the same pressures as the manufacturing sector in attempting to maintain its competitive position.

Adverse Developments in the Overseas Trading Environment

The sharp fluctuations in commodity prices and the slow rate of economic expansion in recent years have led major importing countries to take actions which have had an adverse impact on countries exporting primary commodities. The following developments particularly affected Canada's position in agricultural trade.

Increased Use of Export Subsidies or Restitutions

The EEC in particular continues to make extensive use of export subsidies (restitutions) to gain entry into overseas markets. This aggressive pricing of exports by the EEC has resulted in the loss of traditional export


CANADA AGRICULTURAL TRADE
DAIRY PRODUCTS
Volume Index (1965-1969=100)
$ Million*
Trade Balance (Million)
Imports (Index)
Exports (Index)
TOBACCO
Volume Index (1965-1969=100)
$ Million*
Trade Balance (Million)
Imports (Index)
Exports (Index)
FRUITS AND NUTS
Volume Index (1965-1969=100)
$ Million*
Imports (Index)
Exports (Index)
Trade Balance (Million)
VEGETABLES
Volume Index (1965-1969=100)
$ Million*
Imports (Index)
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1971 '72 '73 '74 '75 '76 '77
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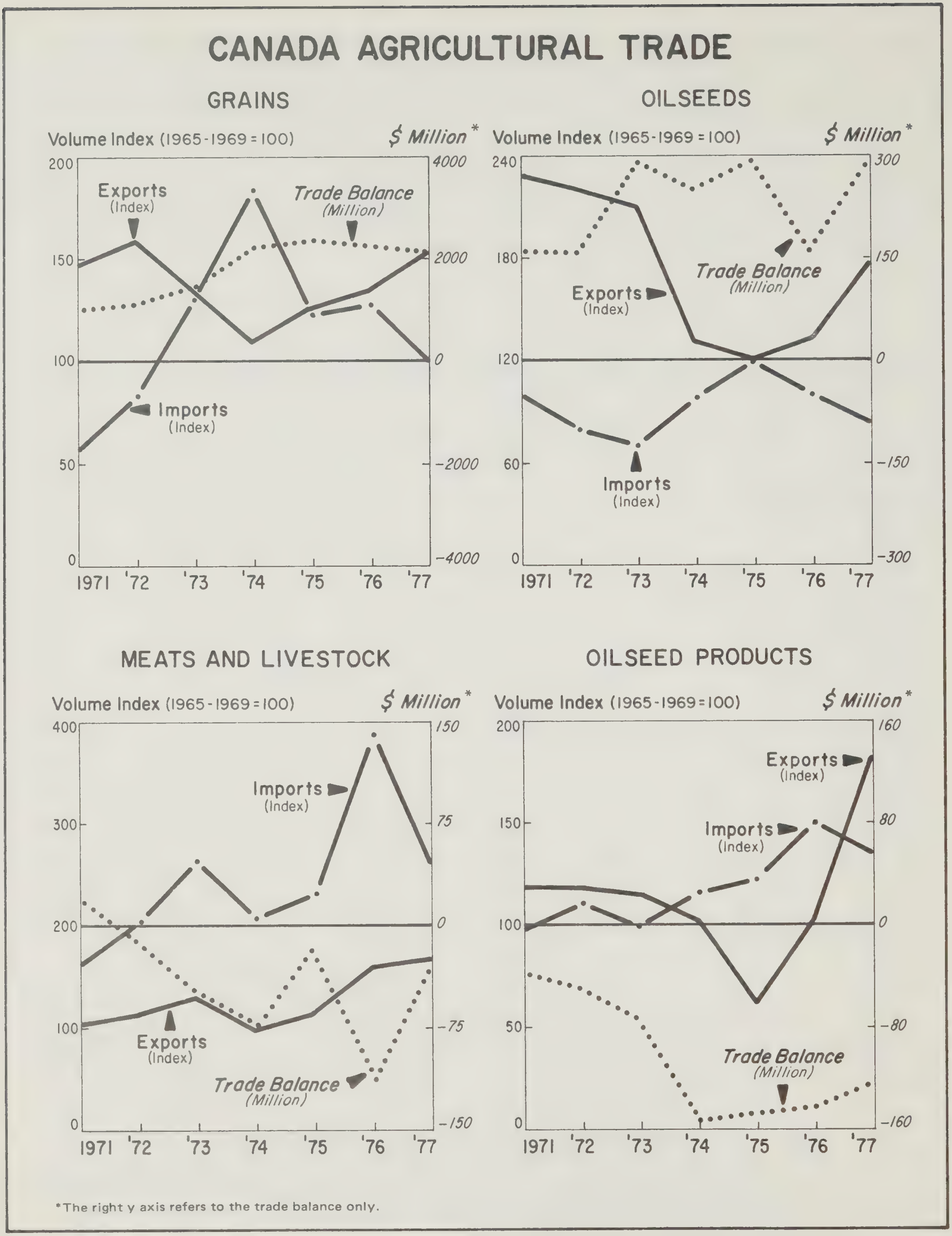
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$ Million*
Exports
(Index)
Trade Balance
(Million)
Imports
(Index)
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'72
'73
'74
'75
'76
'77
OILSEEDS
Volume Index (1965-1969 = 100)
$ Million*
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Exports
(Index)
Imports
(Index)
MEATS AND LIVESTOCK
Volume Index (1965-1969 = 100)
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Imports
(Index)
Exports
(Index)
Trade Balance
(Million)
OILSEED PRODUCTS
Volume Index (1965-1969 = 100)
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Exports
(Index)
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(Million)
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Live cattle exports to the United States increased while the level of beef and veal shipments was generally maintained under the arrangement to regulate the two-way trade in beef and veal between Canada and the United States. Although pork imports in 1977 continued at a high level, $149 million, pork exports (mainly to Japan) reached a record level of 93.8 million pounds, valued at $116 million. This resulted in a reduced trade deficit for pork of $33 million which was a factor contributing to the positive balance in the meat and livestock sector of $32 million, compared with the deficit of $98 million in 1976. Exports of dairy products at $92 million were substantially higher, mainly reflecting increased sales of skim milk powder. The butterfat exchange program operated by the Canadian Dairy Commission (CDC) during part of 1977 also resulted in additional overseas sales of whole milk powder, evaporated milk and other dairy products containing butterfat. Export gains were also achieved in other commodity groups which in previous years had shown some difficulty in maintaining export levels. These include fruits and vegetables, seeds for sowing, maple products and tobacco.

The improved export performance in 1977 is summarized in Table 2. The total trade balance for competitive (supplementary) commodities rose 14.4 percent from $1,774 million in 1976 to $2,029 million, despite a decline in the balance of trade in grains which decreased 5.3 percent, reflecting the lower level of world grain prices, in 1977.

The substantial improvement in exports was not quite sufficient to offset the large increase in the value of imports of products not available in Canada. These complementary imports increased 42.1 percent from $955 million in 1976 to $1,357 million last year. This sizeable increase was mainly the result of sharply higher world prices for imported beverages such as coffee, cocoa and tea, but also of a generally higher level of import prices due to the lower value of the Canadian dollar.

FACTORS AFFECTING CANADA'S AGRICULTURAL TRADE IN RECENT YEARS

Several factors are responsible for the less favorable conditions which have faced Canadian agricultural producers since the early 1970s: general economic conditions, adverse developments in the overseas trading environment, and developments in the domestic industry. These are discussed below in relation to individual commodities and in some cases specific export markets.

General Economic Conditions

Rate of Economic Growth

As in other sectors of the economy, agricultural exports have been adversely affected by the slower pace of economic activity in most developed economies. Moreover, recent improvements in the United States have been less beneficial to agricultural exports than to other exports since the United States is less important as an export outlet for agricultural products than for industrial products. The slow rate of economic growth in many export markets has had a particularly adverse effect on exports of livestock products, e.g., meats and cheese.

Exchange Rate

From 1974 to 1976 agricultural exports faced stiff competition because of the continuing high value of the Canadian dollar in relation to the currencies of most other countries. In recent months, however, the fall in the value of the Canadian currency has reversed this situation somewhat.

Deteriorating Competitive Position

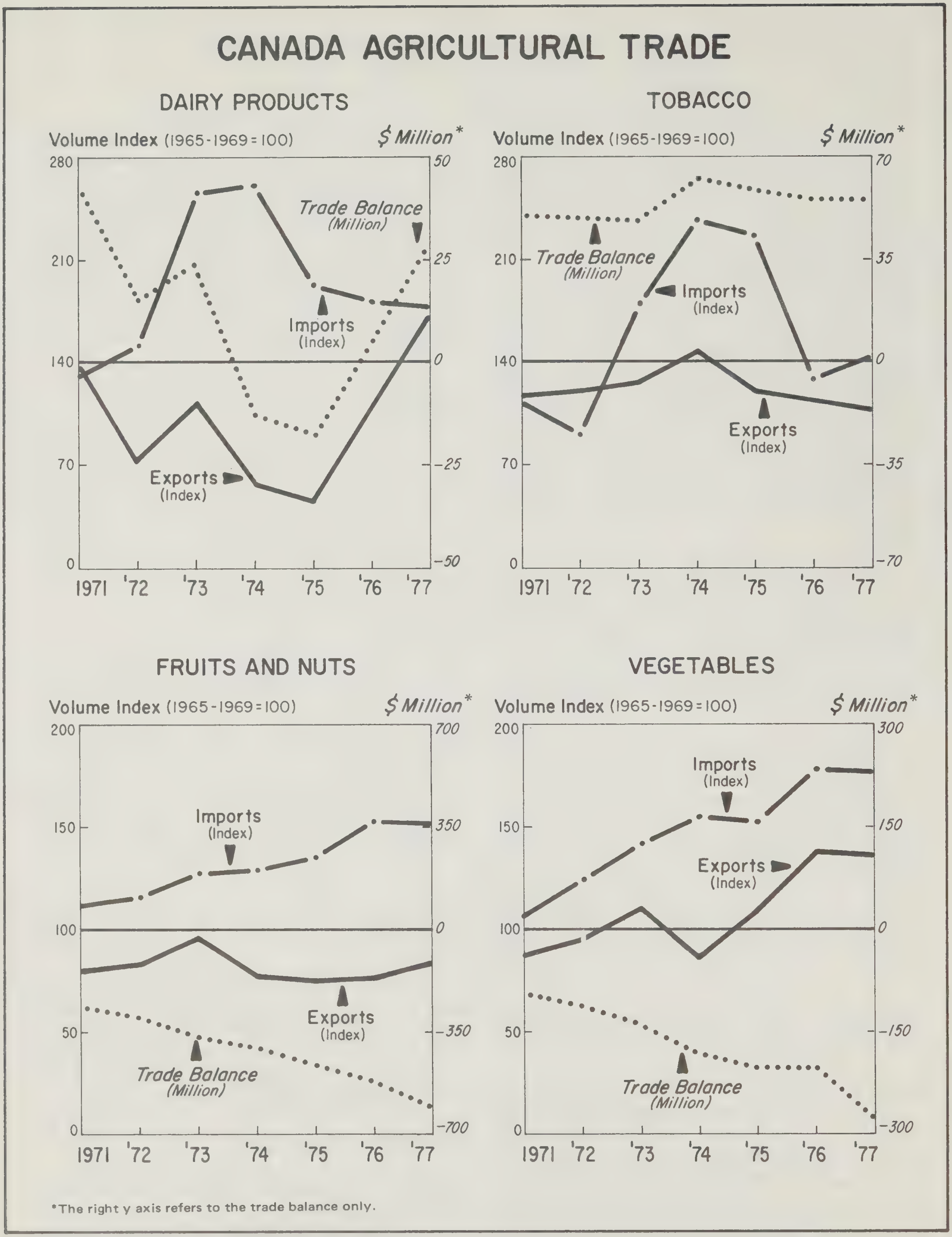
The higher rate of increase in production costs in Canada than in many competing countries, particularly for labor, machinery, and energy, has resulted in some agricultural exports becoming less competitive on world markets – especially where there is a significant labor element in the cost of production, e.g., processed fruits and vegetables. In this context the agricultural industry is facing the same pressures as the manufacturing sector in attempting to maintain its competitive position.

Adverse Developments in the Overseas Trading Environment

The sharp fluctuations in commodity prices and the slow rate of economic expansion in recent years have led major importing countries to take actions which have had an adverse impact on countries exporting primary commodities. The following developments particularly affected Canada's position in agricultural trade.

Increased Use of Export Subsidies or Restitutions

The EEC in particular continues to make extensive use of export subsidies (restitutions) to gain entry into overseas markets. This aggressive pricing of exports by the EEC has resulted in the loss of traditional export



CANADA AGRICULTURAL TRADE
DAIRY PRODUCTS
Volume Index (1965-1969=100)
$ Million*
Trade Balance (Million)
Imports (Index)
Exports (Index)
280
210
140
70
0
50
25
0
-25
-50
1971 '72 '73 '74 '75 '76 '77
TOBACCO
Volume Index (1965-1969=100)
$ Million*
Trade Balance (Million)
Imports (Index)
Exports (Index)
280
210
140
70
0
70
35
0
-35
-70
1971 '72 '73 '74 '75 '76 '77
FRUITS AND NUTS
Volume Index (1965-1969=100)
$ Million*
Imports (Index)
Exports (Index)
Trade Balance (Million)
200
150
100
50
0
700
350
0
-350
-700
1971 '72 '73 '74 '75 '76 '77
VEGETABLES
Volume Index (1965-1969=100)
$ Million*
Imports (Index)
Exports (Index)
Trade Balance (Million)
200
150
100
50
0
300
150
0
-150
-300
1971 '72 '73 '74 '75 '76 '77
*The right y axis refers to the trade balance only.

Figure 4

Improved transportation facilities are opening up new export markets.

exports reached record levels in each of the last six years,[2] and it will be important to ensure that the provisions of national supply management programs do not inhibit Canadian producers from also taking advantage of export opportunities in this area.

SUMMARY AND CONCLUSIONS

The value of agricultural exports from Canada again reached record levels in 1977 despite the lower levels of most commodity prices on world markets. The increased export volume followed an extended period during the early 1970s when export volumes of many non-grain commodities decreased. This, coupled with a higher level of imports led to increasing trade deficits in many commodity areas. The improved trade figures for 1977 have significantly redressed this situation, and there are now favorable prospects for further increases in exports of farm products.

Several factors are improving the export outlook for a range of farm products. The lower value of the Canadian dollar in relation to many other currencies is providing a competitive edge for Canadian exports in many markets. Similarly, the improved terms of access which will follow from the MTN should create new opportunities for farm exports in a number of countries, particularly in the United States, the EEC, and Japan. In addition, important new markets are emerging as well as demands for new products which Canada is in a good position to supply. In order that full advantage can be taken of these new opportunities it is important that emphasis continues to be placed on improved productivity in both the production and marketing of agricultural commodities. In this way, exports of farm products can make an even more important contribution to Canadian agriculture.

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A PROFILE OF THE GENERAL AGREEMENT ON TARIFFS AND TRADE

This article explains the origins and nature of this much talked about but little understood organization for international trade co-operation.

It outlines the history of the GATT, summarizes the General Agreement, describes the structure of the organization and briefly reviews the present round of multilateral trade negotiations.

*A.A. Darisse**

INTRODUCTION

Because trade accounts for 40 percent of Canada's farm cash receipts,[1] this country has a vital interest in everything that affects the movement of goods across its border. This movement is largely governed by the rules and regulations of the General Agreement on Tariffs and Trade (GATT) of which Canada is an original signatory.[2]

To fully understand the GATT, it is necessary to know the history and nature of its organization and operations. This article attempts to provide concise information on these aspects so that readers will better understand this important international organization.

*The author is co-editor of *Canadian Farm Economics,* a periodical of the Special Services Unit of Agriculture Canada's Information Services. He thanks Jim Lohoar, Acting Head, Philip Stone and Arnold de Leeuw, economists, of the Trade Policy Unit, Agriculture Canada, for their invaluable comments and suggestions.

[1] Lohoar, J., "Canada's Agricultural Trade-Recent Developments and Prospects," *Canadian Farm Economics,* 13 (August 1978) 4.

[2] To avoid ambiguity, "General Agreement" is used as a reference to the basic document and "GATT" to the organization that applies its rules and regulations.

ORIGINS OF THE GATT

At the end of World War II the world faced a severely troubled economy and the difficult trade barriers it had inherited from the economic crisis of the late 1920s and 1930s. Discussions began on the creation of institutions which would improve the international trade and payments system and limit the kinds of practice that had hindered world trade during the 1930s, when many governments established protective trade barriers such as high tariffs, import quota restrictions, and exchange controls. The first such institution was the International Monetary Fund (IMF), created at the Bretton Woods Conference in 1944. It was set up to provide a multilateral payment system and to help countries overcome short-term balance-of-payment problems without resorting to import restrictions. Besides this innovation, plans were discussed for the negotiation of a world trade charter which would include an international commercial code.

The International Trade Organization and the GATT

In November 1945 the U.S. Department of State published its "Proposals for Expansion of World Trade and Employment." This document set out general principles for a multilateral trading code and proposed the creation

of an international trade organization. Though the United States initiated a conference to discuss the "Proposals", the work was taken over by the Economic and Social Council of the United Nations in March 1946. The Council organized a preparatory committee to draft the charter for the International Trade Organization (ITO).

While this was being done, the member countries of the preparatory committee agreed to sponsor negotiations to lower customs tariffs and reduce other trade restrictions without waiting for the ITO to be created. It was in these circumstances that the first tariff negotiating conference was held in Geneva in 1947. The tariff concessions realized at this conference were written

TABLE 1. GATT MEMBERS, OCTOBER 1977

Contracting Parties to the GATT (83)		
Argentina	Greece	Norway*
Australia*	Guyana	Pakistan
Austria	Haiti	Peru
Bangladesh	Hungary	Poland
Barbados	Iceland	Portugal
Belgium*	India*	Rhodesia*
Benin	Indonesia	Romania
Brazil*	Ireland	Rwanda
Burma*	Israel	Senegal
Burundi	Italy	Sierra Leone
Cameroon	Ivory Coast	Singapore
Canada*	Jamaica	South Africa*
Central African Empire	Japan	Spain
Chad	Kenya	Sri Lanka*
Chile*	Korea, Rep. of	Sweden
Congo	Kuwait	Switzerland
Cuba*	Luxembourg*	Tanzania
Cyprus	Madagascar	Togo
Czechoslovakia*	Malawi	Trinidad and Tobago
Denmark	Malaysia	Turkey
Dominican Republic	Malta	Uganda
Egypt	Mauritania	United Kingdom*
Finland	Mauritius	United States of America*
France*	Netherlands*	Upper Volta
Gabon	New Zealand*	Uruguay
Gambia	Nicaragua	Yugoslavia
Germany, Fed. Rep. of	Niger	Zaire
Ghana*	Nigeria	
Acceded Provisionally (3)		
Colombia	Philippines	Tunisia
Countries to whose territories the GATT has been applied and which now, as independent states, maintain a de facto application of the GATT pending final decisions as to their future commercial policy (25)		
Algeria	Guinea-Bissau	Sao Tome and Principe
Angola	Kampuchea	Seychelles
Bahamas	Lesotho	Surinam
Bahrain	Maldives	Swaziland
Botswana	Mali	Tonga
Cape Verde	Mozambique	United Arab Emirates
Equatorial Guinea	Papua New Guinea	Yemen, Democratic
Fiji	Qatar	Zambia
Grenada		

*Original member (China, Lebanon, and Syria were also original members.)

Source: GATT: *What It Is, What It Does,* GATT Information Service.

into a multilateral contract called the General Agreement on Tariffs and Trade. It was signed on October 30, 1947 and came into force on January 1, 1948 (Table 2). Its most important effect was to substantially reduce U.S. tariffs, which had been raised to high levels in the early 1930s. As such, it helped Western Europe's economy to recover.

TABLE 2. GATT ROUNDS OF MULTILATERAL TRADE NEGOTIATIONS

Order	Date	Location
1st	1947	Geneva (Switzerland)
2nd	1949	Annecy (France)
3rd	1951	Torquay (England)
4th	1956	Geneva
5th	1960-62	Geneva
6th	1964-67	Geneva[a]
7th	1973-	Geneva[b]

[a]Kennedy Round.
[b]Tokyo Round.

The ITO, on the other hand, was never established. The charter was not completed until March 1948, when it was signed in Havana by 53 countries. The signatories, however, would not commit themselves until the United States clearly defined its position on the ITO. This was done in December 1950 when the U.S. Administration announced that it would not submit the charter to Congress for ratification, a decision that eliminated all hope of creating the ITO.

Hence the GATT, although originally designed as a temporary arrangement, was the only international body that provided the framework necessary for improving world trade through international co-operation.

THE GENERAL AGREEMENT

The General Agreement contains a code that governs trade conduct among its signatories. It defines the rights and obligations to which GATT members, as importers and exporters, must conform. These rules and regulations define the framework within which almost 100 countries must establish their trade policies and within which 85 percent of world trade is carried out. Since trade is such a vital element of the Canadian farm economy, it is important that all sectors understand the General Agreement.

The member governments have not ratified the General Agreement and it is therefore only applied provisionally. The reason for its qualified application is that, at the time when the General Agreement was signed, many member countries had legislation that conflicted with certain provisions in Part II, a situation that would have prevented their accession to the GATT had this part been made mandatory. The provisional application is a legal device to circumvent that problem.[3]

The General Agreement has four fundamental principles: 1. that trade should be conducted on a non-discriminatory basis; 2. that domestic industries should only be protected by customs tariffs and not through other commercial measures; 3. that there should be consultation to avoid damaging members' trading interests; and 4. that the GATT provide the framework within which negotiations can be held for the reduction of tariffs and other trade barriers.

Part I

Article I guarantees most-favored-nation treatment for member countries. This means that any concession or privilege granted by one member country to another is immediately and unconditionally granted to all other member countries. In effect, though the negotiations at tariff conferences are conducted bilaterally,[4] they are multilateral in that any reduction agreed upon is applied to all GATT members.

Article II provides for the actual tariff reductions. They are listed in the schedules annexed to the General Agreement and are therefore part of the agreement itself.

Part II

Article III prohibits internal taxes which discriminate against imports. In principle, member countries are not allowed to levy or increase taxes on products they import if those taxes discourage access to or sale in their domestic market. For example, if a member country imposes a tax on product A, an import, which hampers its sale in favor of product B, a domestic product which can be substituted for A, the member country exporting A may complain to the GATT. This is a measure to prevent taxes from being used as a non-tariff protective measure.

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[3]This is known as the Protocol of Provisional Application.

[4]In other words, between two countries.

Articles IV to X prevent or control other tariff substitutes (non-tariff measures), in particular those concerning films (IV), freedom of transit (V), anti-dumping and countervailing duties (VI), customs valuation (VII), fees and formalities (VIII), marks of origin (IX), and trade regulations (X).[5]

Articles XI to XIV deal with quantitative restrictions or quotas which limit the import volume. Article XI prohibits them generally while providing some exceptions. One of these allows for import quotas necessary for the proper functioning of a supply management scheme. An example would be Canada notifying the GATT of its intention to impose import quotas on eggs and turkeys to protect those two supply management schemes. Article XII specifies how quantitative restrictions may be used for balance-of-payment reasons; XIII requires that they be used without discrimination; and XIV specifies exceptions to XIII.

Article XV concerns GATT co-operation with the IMF. The latter provides the GATT the information it needs on foreign exchange, monetary reserves, and balance of payments.

Article XVI calls for the elimination of export subsidies that tend to increase the exports of one member country while hurting the commercial interests of other member countries.

Article XVII requires that state trading enterprises not discriminate in their foreign trade.

Article XVIII recognizes that developing countries might need tariff flexibility and the possibility of applying some quantitative restrictions to conserve foreign exchange.

Article XIX states when emergency action may be taken against imports that hurt domestic producers. In carefully identified situations, this article provides a safeguard provision that allows a member country to impose short-term import restrictions or to withdraw past concessions on products being imported in such increased quantities or under such conditions that they threaten to injure competing domestic producers.[6]

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[5]The Tokyo Round has concentrated on a number of non-tariff barriers and negotiations are taking place in five sub-groups: 1. Quantitative Restrictions; 2. Subsidies and Countervailing Duties; 3. Technical Barriers to Trade; 4. Customs Matters; and 5. Government Procurement. For further details see the section on the Tokyo Round.

[6]Subject of discussion in the Tokyo Round.

An example is Canada's occasional imposition of a surtax on certain low-priced imports of perishable horticultural products and grain corn. This protects the competitiveness of Canadian products on the domestic market which is threatened when end-of-harvest U.S. products are available at depressed prices and Canadian products are just beginning to reach the market.

Article XX defines general and Article XXI security exceptions to the General Agreement, for example, measures to protect public health.

Article XXII concerns consultations and XXIII the settlement of disputes. One of the underlying principles of the General Agreement is that member countries should consult one another on trade questions and problems. If a country believes that it is not benefitting as it should or that it cannot achieve an objective of the General Agreement because of measures taken by another member country, it may seek formal consultation with that country. If it finds this consultation unsatisfactory, it may lodge a formal complaint. This would be investigated and is subject to the rules and recommendations of Article XXIII. If the complaint is found to be justified, the complainant may be authorized to suspend the application towards the other country of a concession or other obligations under the General Agreement. For example, when Canada introduced its egg supply management system and set import quotas on that product, the United States sought consultation under Article XXII claiming that Canada had contravened Article XIII. Bilateral consultations failed to satisfy the United States and it requested that the GATT investigate Canada's action. A Panel of Conciliation, composed of member countries who had no direct interest in the matter, was created; it found that Canada's action was generally consistent with Article XIII, but suggested increased import quotas.

Part III

Article XXIV specifies how customs unions and free-trade areas may be exceptions to the most-favored-nation rule. The General Agreement recognizes the value of regional trading arrangements, in which several countries abolish barriers against imports from one another, as a way to integrate national economies through freer trade. Under strict rules, the General Agreement permits such groupings as long as they encourage trade among the countries involved without raising barriers to countries outside the group. The General Agreement recognizes only two kinds of grouping: customs unions and free-trade areas. In both cases, duties and other

trade barriers among the countries must be removed. In a free-trade area each member retains an individual commercial policy, including its tariffs towards non-members. The customs union has one customs tariff towards non-members. Both must ensure, however, that their duties and other trade regulations towards non-members are no more restrictive than those applied before the group was created. When a grouping affects the tariff structure, negotiations are held to restore the overall balance of trade concessions previously negotiated in the GATT. For example, when the EEC expanded in 1973, a series of negotiations was held under Article XXIV to compensate Canada for its loss of access rights to Great Britain, Ireland, and Denmark, these countries having adopted the Common External Tariff and Common Agricultural Policy.

Article XXV provides for waivers by GATT members. This is a procedure allowing a member country to seek to suspend its application of a GATT obligation. A two-thirds majority of votes cast, which must include over one half of the member countries, must be in favor of such a request for the waiver to be granted.

Articles XXVI to XXXV concern the operation of the GATT. They deal with the following: its acceptance and entry into force (XXVI); withdrawal of tariff concessions from former members (XXVII); rules for tariff negotiations and changes in tariff schedules (XXVIII); the relationship between the GATT and the Havana Charter (XXIX); amendment of the General Agreement (XXX); withdrawal from the GATT (XXXI); the definition of "contracting parties" or members (XXXII); accession to the GATT (XXXIII); the annexes to the General Agreement (XXXIV); and the non-application of the GATT rules between particular members (XXXV).

Part IV

This section was added to the General Agreement during the Kennedy Round[7] in 1965 to deal with the special needs of developing countries.

Article XXXVI concerns the GATT's principles and objectives in meeting those needs, Article XXXVII the commitments of member countries to that end, and Article XXXVIII a provision for joint action by those countries.

[7]So called because the Kennedy Administration initiated and enacted the Trade Expansion Act (1962) to stimulate U.S. economic growth by increasing foreign markets for U.S. products.

THE ORGANIZATION OF THE GATT

The highest authority of the GATT is its Session of Contracting Parties. Its decisions are generally made by consensus and not by vote. When voting is held, and this is rare, each member country has one vote. Most voting decisions are taken by simple majority, the exception being waivers (Article XXV).

Between sessions a Council of Representatives is authorized to act on both routine and urgent questions. It meets about nine times a year and is composed of nominated representatives of contracting parties willing to accept the responsibilities of membership.

The Trade Negotiations Committee guides the Multilateral Trade Negotiations (MTN). The Committee is composed of representatives of all 97 countries currently engaged in the negotiations. Under it are seven groups that are directly responsible for the negotiations. They cover the principal themes established in the Tokyo Declaration:[8] tariffs, non-tariff measures, agriculture, safeguards, the sector approach to negotiations, tropical products, and improvement in the international framework for the conduct of world trade.[9]

The GATT secretariat in Geneva has a staff of 200 headed by a director-general.[10]

THE TOKYO ROUND

So called because it was initiated at the Tokyo Ministerial Meeting of September 1973, the Tokyo Round of multilateral trade negotiations seeks to liberalize world trade by reducing or eliminating tariffs and non-tariff barriers, and to secure additional benefits for developing countries so that they can increase their export earnings.

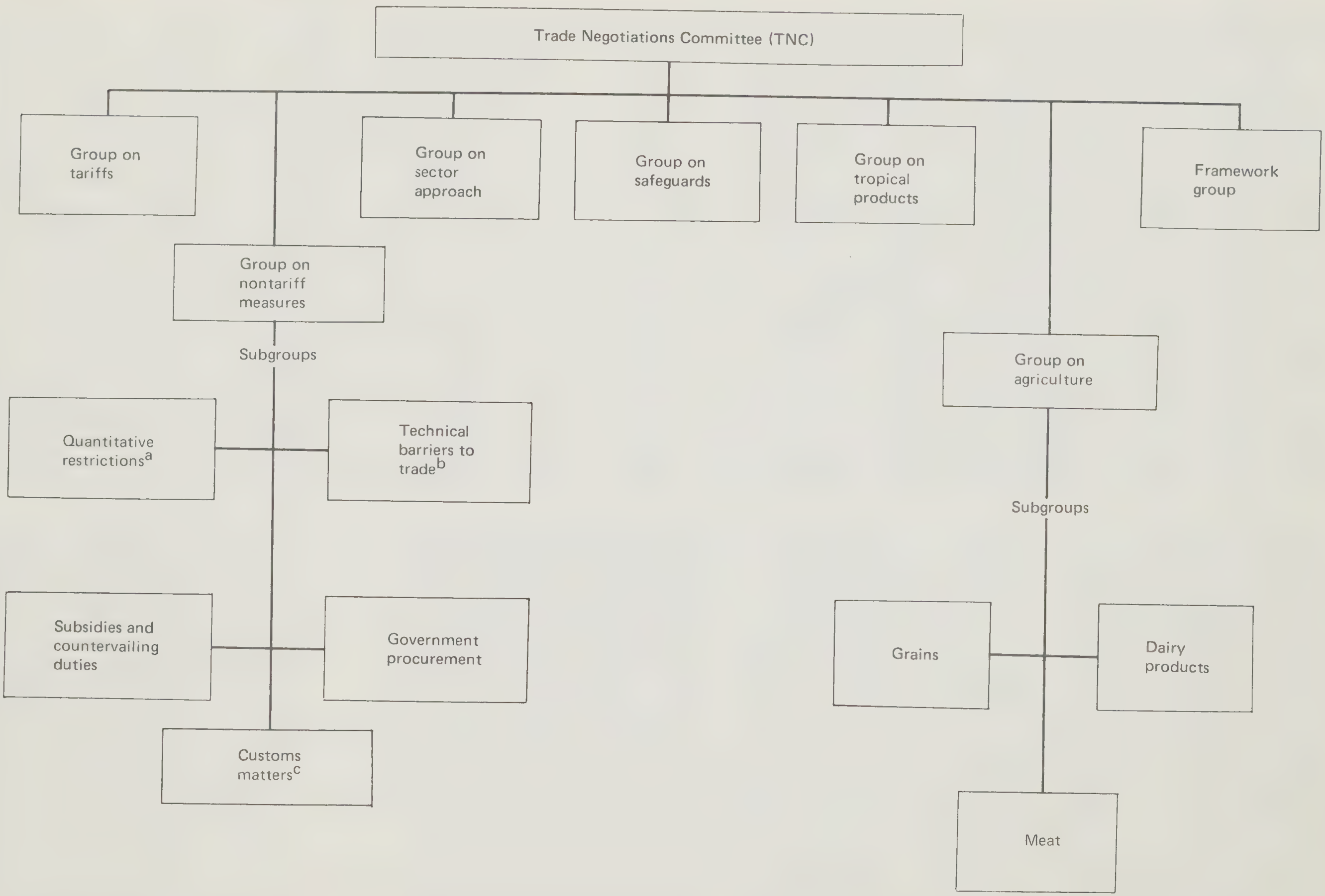
As mentioned earlier, the Trade Negotiations Committee oversees the seven negotiating groups whose work is briefly described below.

[8]The declaration, made at the end of the Tokyo Ministerial Meeting in September 1973, is the document that stated the objectives of the present round of negotiations.

[9]Four other important committees are the Committee on Trade and Development, the Consultative Group of Eighteen, the Balance of Payments Committee, and the Anti-Dumping Committee.

[10]A Special Assistance Unit provides technical assistance to developing countries to help them participate fully in the mutilateral trade negotiations.

ORGANIZATIONAL STRUCTURE OF THE MULTILATERAL TRADE NEGOTIATIONS (MTN)



[a]Import and export quotas and restrictions, licensing procedures, etc.

[b]Standards, packaging and labelling, and marks of origin, etc.

[c]Customs valuation, import documentation, consular formalities, customs procedures and customs nomenclature, etc.

Source: Finance & Development, 15 (March 1978) 1, a quarterly publication of the International Monetary Fund and the World Bank.

Tariffs

This group was made responsible for negotiating tariff-cutting approaches, drawing up rules for exceptions, and designing measures and procedures for giving special treatment to the exports of developing countries.

Three tariff-cutting approaches were identified. The first was an item-by-item approach which had been used in previous negotiations and in this round for agricultural products. This involved bilateral negotiations with the concessions applied to all GATT members. The second, used in the Kennedy Round, consisted of making a straight or "linear" cut across the board, all tariffs being reduced a fixed percentage regardless of how high or low they were initially. The third (including the modified Swiss formula which became the basis for negotiating industrial tariffs) would not only cut tariffs, but harmonize or bring them closer. This would involve a steeper reduction of high rather than low tariffs. In other words, the higher the tariff, the greater the cut. The major participants in the negotiations favor the third approach.

Non-Tariff Measures

The Tokyo Round is different from previous rounds in its emphasis on non-tariff barriers to trade. The negotiations have been divided into the following five sub-groups:

1. Quantitative Restrictions, which include import prohibitions, export restraints, and licensing procedures;
2. Subsidies and Countervailing Duties, which include duties imposed to offset the low prices of imports attributable to subsidies by the exporting country;
3. Technical Barriers to Trade, which covers items such as standards, packaging and labelling requirements, and marks of origin;
4. Customs Matters, covering customs valuation, import documentation (including consular formalities), customs nomenclature and procedures; and
5. Government Procurement.

This group is attempting to establish conduct codes that will eliminate some of the uncertainty that has existed in these areas, to ensure that access to foreign markets is not improperly impeded, and to guarantee that measures applied by member countries follow agreed rules.

Agriculture

The main impediments to international trade in agricultural products are generally non-tariff barriers and not tariffs. Because of social, economic, and political considerations, it has been difficult to negotiate non-tariff barriers. Agricultural trade has been affected by production-support programs and import measures which have resulted in surpluses sold on world markets at subsidized prices. Despite all the problems involved, negotiating members have identified three areas which they believe can be solved multilaterally: grains (including coarse), dairy products, and meats. The grain discussions have dealt with price and market stabilization; trade expansion and liberalization; and the interests of developing countries, including the objective of special or differential treatment. There have been parallel grain discussions at the International Wheat Council's meetings in London which will have a direct bearing on the outcome of the GATT negotiations. Proposals have been made to achieve greater management and stabilization of world markets for dairy products and meat. Outside the Tokyo Round, arrangements negotiated in the GATT regulate international price competition of certain dairy products by fixing minimum export prices for skim milk powder (1970) and butter oil (1973).

Horticulture is another area important to Canada in the present round of multilateral trade negotiations. In its recent study of Canada's fruit and vegetable industry, the Tariff Board recommended an overall increase in our tariff protection. To do this, Canada must negotiate any increase in duty with the United States and other principal suppliers of fresh and processed horticultural products within the provisions of Article XXVIII. Virtually all the tariffs reviewed by the Tariff Board in the study are "bound" in the General Agreement against increases.[11] Under Article XXVIII, however, a country may increase a bound tariff if it compensates those countries which paid for or benefited from the original tariff binding. Initially these countries will request compensation in the horticulture sector and then in other agricultural sectors. Failure to reach agreement on compensation could result in Canada's trading partners withdrawing previously granted tariff reductions on products of export

[11] When one member country agrees with another to "bind" its tariff on a particular item, it commits itself to not raising the tariff above the agreed level. These bound rates are included in the schedules and are a part of the General Agreement.

interest to Canada. The government has begun negotiating with its trading partners to provide greater protection for its fruit and vegetable industry.

Safeguards

This group is trying to improve the safeguard provisions in Article XIX which allow a member country to impose import restrictions or withdraw concessions on products being imported in such quantities or under such conditions that they threaten the competing domestic industry. Canada is seeking safeguard provisions that will allow speedy action concerning perishable horticultural products.

The Sector Approach

This group, of particular importance to Canada, is discussing the possibility of reducing or eliminating all trade barriers in selected sectors. Some GATT member countries like Canada see it as an effective way of dealing at one time with a whole range of obstacles which affect trade in a raw material and its semi-finished and finished by-products.

Tropical Products

Considered a priority item, most developed countries gave trade concessions on imports of tropical products in 1977 to open markets for developing countries. This group is negotiating further reductions.

Framework for the Conduct of World Trade

Established in November 1976 by the Trade Negotiations Committee, this group is trying to improve the framework of international trade by reviewing several provisions of the General Agreement, especially those that affect trade between developed and developing countries with a view of providing more favorable treatment to the latter. The specific issues being discussed are the contractual basis for trade relations between developed and developing countries; recourse to safeguard actions for balance-of-payment reasons and for the promotion of development efforts; dispute settlement procedures; and reciprocity in negotiations involving developing countries.

SUMMARY

Though originally designed as a temporary arrangement, the GATT has become the instrument and forum for greater world trade through international consultation and co-operation. Its rules for the conduct of trade are accepted by almost 100 of the world's trading nations.

The GATT is guided by four fundamental principles: 1. that trade should be conducted on the basis of non-discrimination, 2. that domestic industries should only be protected by customs tariffs, 3. that there should be consultation aimed at avoiding damage to members' trading interests, and 4. that the GATT should provide the framework within which negotiations can be held for the reduction of tariffs and other trade barriers.

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SOME OBSERVATIONS ON THE CATTLE CYCLE IN CANADA

This paper provides a perspective on the nature and causes of cattle cycles. It suggests that grain price fluctuation was a major factor inducing the last downturn in the cycle which was the most severe in recent history. Attempts to stabilize the cattle cycle, therefore, must recongize the influence of grain prices.

*G.E. Pugh**

INTRODUCTION

Production and price instability for agricultural commodities continue to be major economic problems in Canadian agriculture. Of primary concern is the alternation between periods of excess and deficient supplies of particular commodities, relative to demand, and the consequent effect on prices and producers' incomes. The concern is primarily for the welfare of the producers involved, but also for the efficient allocation of resources, not only at the farm level but throughout the entire economic system.

While production and price instability, i.e., alternating "boom" and "bust" periods, exist for many agricultural commodities, the regularity and predictability of these periods are more evident for some than for others. For most grains, for example, these periods are due less to producers' intentions for domestic production than to factors which affect international demand. These factors can be as unpredictable as drought in a major importing country or a change in government policy. There are other commodities such as cattle and hogs, however, for which these periods of varying prosperity have been due more to domestic production and supply conditions relative to domestic demand than to other factors. Given the economic factors which influence production and supply, the alternation between depression and prosperity in these industries has been fairly regular.

Variations in the general prosperity of the cattle industry have been regular enough to be called a cycle. This paper contains a discussion of the nature and causes of the cattle cycle, some of the more pertinent details of the three most recent cycles, and some conclusions.

NATURE OF THE CATTLE CYCLE

That the cattle industry goes through alternating periods of prosperity and depression has been recognized for some time.[1] The nature and causes of these periods, however, have been subjects of debate. Various cyclical tendencies in the industry have been identified. There appears to be a cycle in cattle inventory, one in cattle

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[1] See for example, E.C. Voorhies and A.B. Koughan, *Economic Aspects of the Beef Cattle Industry*, California Agricultural Experiment Station, Bull. No. 461, 1921.

marketings, and another in beef supplies.[2] It was only recently recognized that all of these cycles were in fact causally-linked,[3] and that the net effect was alternating periods of sustained price increases and decreases. Today it is generally agreed, therefore, that the effects of these various cycles constitute "the cattle cycle."

Discussion on the factor or factors which trigger cattle cycles still lacks clarity. There have been strong arguments supporting both a "self-generated" cycle,[4] and an externally-influenced cycle.[5] Self-generation suggests that each phase of a cycle progressively triggers succeeding phases. Central to this argument is the assumption that present cattle prices form the basis upon which expectations of future cattle prices are formed.[6] For example, rising cattle prices would induce cow-herd growth and expanded calf production, since producers would anticipate that current price gains would be sustained. Cow-herd growth, however, can only be accomplished by culling fewer cows and withholding more heifers. Feeder and fed cattle marketings, therefore, would be reduced and price rises reinforced. Eventually the expanded cow-herd would result in increased cattle marketings. Marketings would eventually expand to the point relative to demand such that current prices could not be maintained and prices would soften or start to fall. Since producers would view softening or falling prices pessimistically, they would tend to be discouraged from further expansion and induce some reduction. As fewer heifers were withheld and cows more vigorously culled, total marketings would rise even further and price declines would be accentuated. Cow-herd reduction would then gather momentum and continue until cattle marketings were sufficiently reduced to warrant some price increase. Again cow-herd expansion would be induced and a new cycle begun.

Arguments for exogenously-generated cycles emphasize factors which trigger increases or decreases in cattle marketings, but which are not at the time related directly to cattle or beef supplies.

A distinct split is evident among cattle producers according to type of operation. There are cow-calf men who own the basic cow herd and produce feeder stock, and there are cattle feeders and finishers to whom feeder stock is only one, though the most important, input. This specialization in production resulted from the increased grain finishing of cattle. This has not always been the case. Estimates indicate that marketed cattle in the United States were fed 55 percent more grain per head in 1972 than in 1960. Almost 80 percent of the cattle marketed in 1972 were grain fed.[7]

The effect that feed grain price increases would have on the profitability of cattle finishing is obvious. The next section suggests that the feed grain price increases in 1973-74 were sufficient to seriously affect demand for feeder cattle, resulting in major decreases in feeder cattle prices, and increased female marketings. What this means is that there is now a well-defined external influence exerted on the cattle industry which can trigger downturns in the cattle cycle.

Other analysts have emphasized short-term changes in demand for beef as the triggering mechanism for increases or decreases in prices and thus turning points in the cycle. This would appear to be true in the 1930s and following World War II. Since demand is difficult to measure, however, it is difficult to substantiate this possibility.

Today most analysts agree, at least implicitly, that the evidence is strong for a self-generating cattle cycle. Historical data show that there has been a long-term trend of expanding cattle numbers, marketings, and beef production. It can be presumed that the factor underlying this expansion is the growth in demand, reflecting growth in consumer income and population. It would also appear that from time to time growth in beef production has exceeded the growth rate of demand and that prices have been depressed.

It also seems, however, that despite this tendency for self-generation, at least one (i.e., the most recent cycle) cyclical increase in marketings and depressed prices has been induced in advance of an excessive build-up in marketings by factors external to the industry.

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[2] Harold Breimyer, "Observation on the Cattle Cycle," *Agricultural Economics Research,* 8 (January 1955) 1.

[3] Ibid, p.2.

[4] James Lorie, "Causes of Annual Fluctuations in the Production of Livestock and Livestock Products," *Journal of Business,* University of Chicago, 20 (1974) 2. Mordecai Ezekiel, "The Cobweb Theorem," *Quarterly Journal of Economics,* 52 (1938).

[5] C.A. Burmeister, "Cycles in Cattle Numbers," *The Livestock and Meat Situation,* U.S. Bureau of Agricultural Economics, March 1949.

[6] A survey of Oklohoma cattle producers, for example, tends to corroborate this. See Keith Kendall and Wayne Purcell, "The Beef Cycle in the 1970s, Analysis Behavioral Dimension, Outlook and Projection," Agricultural Experimental Station, Oklohoma State University, Bulletin B-721, March 1976.

[7] Harlow J. Hodgson, "We Won't Need to Eliminate Beef Cattle," *Crops and Soils Magazine,* November 1974.

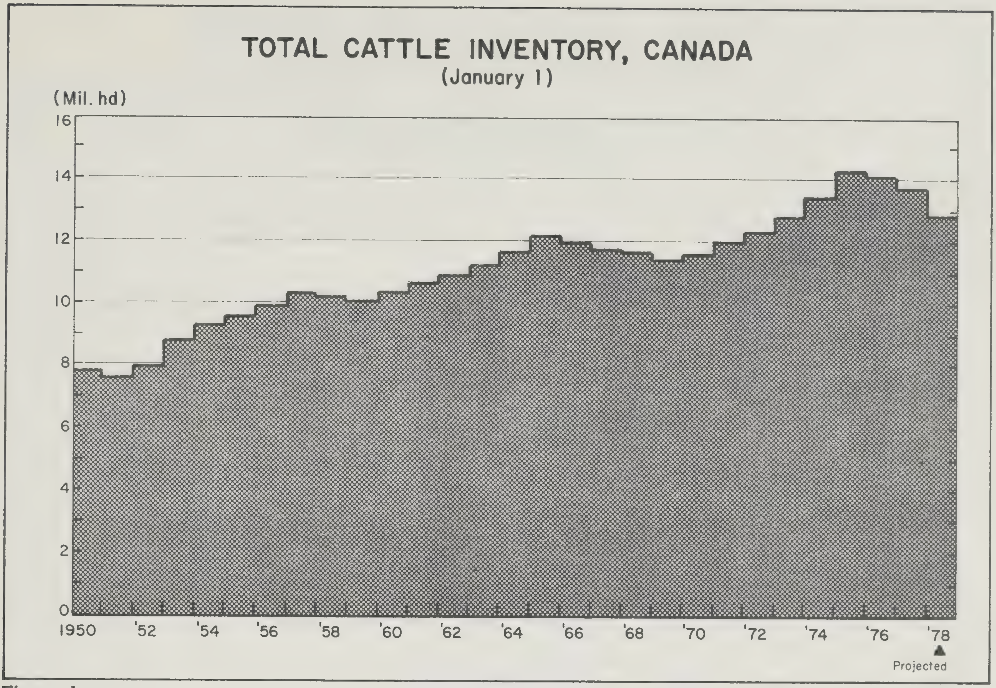

Figure 1

COMPARISON OF THE THREE MOST RECENT CYCLES

The cyclical nature of the cattle industry is most readily apparent in the fluctuations which have occurred in cattle inventory (Figure 1). There have been three digressions from inventory expansion since 1950. The trend towards longer-term expansion is apparent, however, since each peak and low has been higher than preceding highs or lows. Build-up phases have proceeded for six, seven, and six years respectively in each of the last three cycles. Liquidation phases lasted one year and four years in the two previous cycles and it appears that the phase will last four years in the current cycle.

Should the present inventory decline last four years, it would be no longer than the previous one. The magnitude, however, of the current decline is in sharp contrast to any previous decrease. From 1965 to 1969, inventory (January 1) decreased from 12.13 million to 11.4 million head, or 6 percent. Three years of reduction in the current cycle (since January 1975) have already reduced inventory 10 percent, from 14.28 million to approximately 12.87 million head. During the previous inventory reduction, beef-cow numbers decreased only 3 percent; three years of reduction in the current cycle have already reduced beef-cow inventory 12 percent.

The current inventory reduction is therefore the most severe of recent cycles. The severity of this cycle's downturn is also indicated by the disposal rate of female stock (Figure 2). In the two previous cycles, cows rather than heifers made up the greater proportion of increases in female marketings. Heifer marketings did not increase significantly in the 1957-58 inventory decline nor did they exceed cow marketings during the 1965-69 inventory decline. From March 1974 to January 1977, however, heifer marketings increased over 100 percent. While just over 500,000 head of heifers were marketed in 1973, over one million were marketed in 1976 and one million in 1977. Heifers have exceeded cows as a proportion of female marketings in each year since 1974, a situation unprecedented in recent cycles. This suggests that in the current cycle, contrasted to previous ones, the factors underlying the disposal of female stock have been more severe than those in previous downturns. In fact, they were severe enough to not only induce trimming of the existing cow herd, but to also reduce the potential of expanding the cow herd in the future.

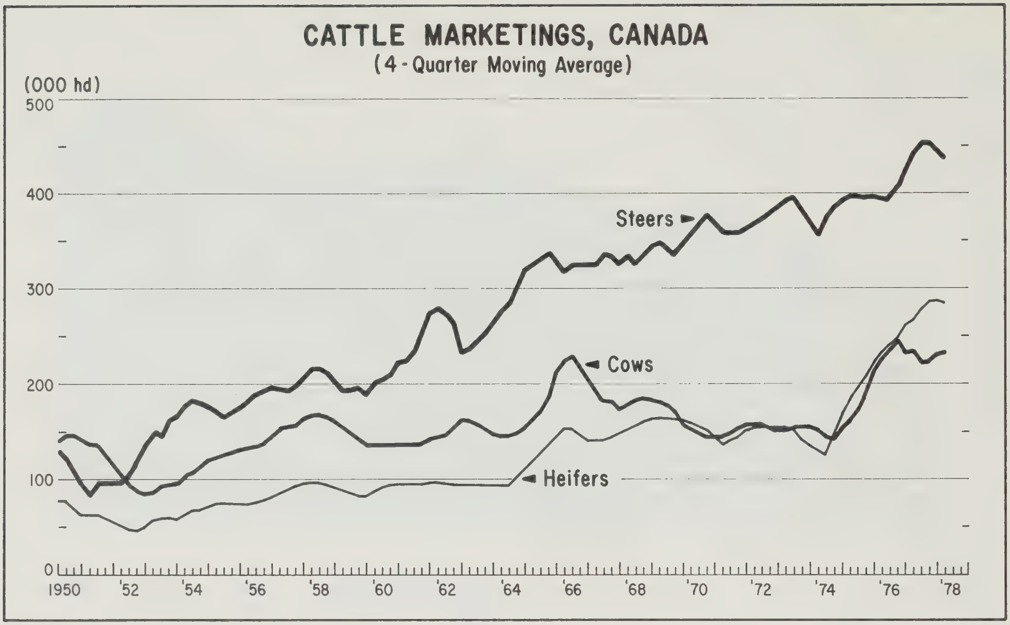

Figure 2

The severity of conditions leading to the current inventory reduction is indicated by the price variation for feeder calves (Figure 3). The magnitude of feeder calf price decreases from 1973 to 1974 are in sharp contrast to any preceding price fluctuation. With the exception of this most recent cycle, feeder calf prices have moved in phase with fed cattle prices. The sharp fluctuations in feeder calf prices relative to fed cattle prices in this most recent cycle represent a departure from past relationships. It has been suggested that this sharp fluctuation in feeder prices is at least partly due to the feed grain price increases of 1973-74.[8] Figure 4 shows variations for No. 1 feed barley (in-store, Thunder Bay). From 1949 to 1972 this price averaged $1.13 a bushel with a maximum deviation of $.39 a bushel from this average. During 1973-74, however, the price more than tripled.[9] This implies that returns to cattle feeders were squeezed, causing feeder prices to be bid lower,[10] and inducing cow-herd reduction. In addition, grain production probably became comparatively more attractive to those producers whose entire incomes were not derived from cattle.

While in previous cycles decreases in finished cattle prices led the general decline in prices, in this past cycle feeder prices decreased two years before those for finished cattle. This further suggests that feeder prices were forced down prior to an excessive build-up in numbers.

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[8] Ibid.

[9] See D. Gale Johnson, "World Agriculture, Commodity Policy and Price Variability," *American Journal of Agricultural Economics,* December 1975, for a discussion of this price increase.

[10] An experiment to test this hypothesis was performed using an econometric model of the beef industry (T.G. MacAulay, "A Recursive Spatial Equilibrium Model of the North American Beef Industry for Policy Analysis," unpublished Ph.D thesis, University of Guelph, Guelph, Ontario, 1976). The experiment consisted of simulating the 1973-78 period assuming that no increases in feed grain prices occurred. The results were largely consistent with expectations. Feeder cattle prices remained higher than fed cattle prices. Cattle inventories decreased, but the decreases were not as severe as those associated with high feed grain prices. On balance, with no increases in feed grain prices the industry appeared to receive less of a shock than that which actually occurred.

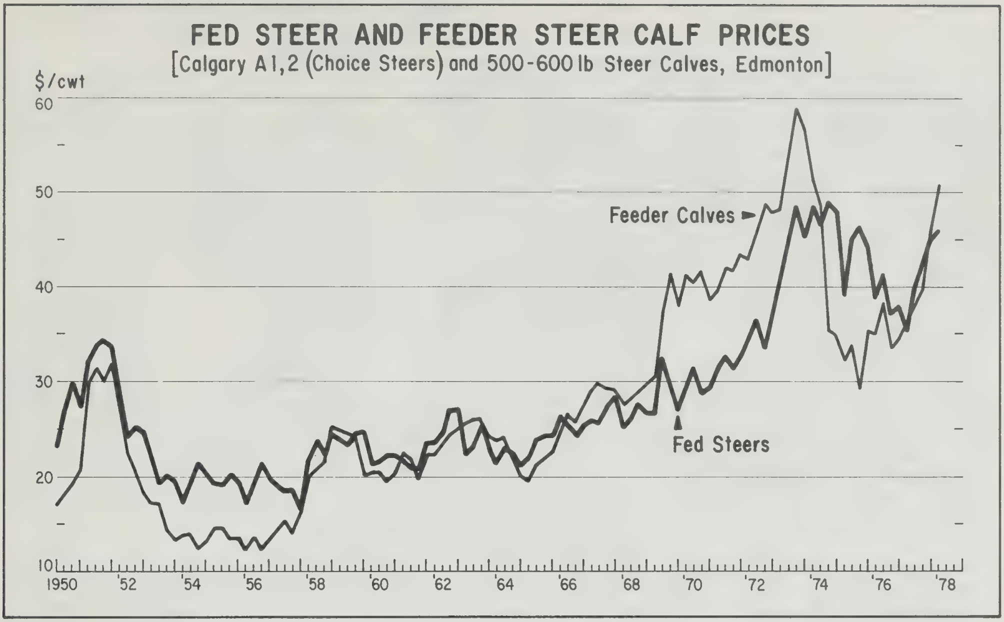

Figure 3

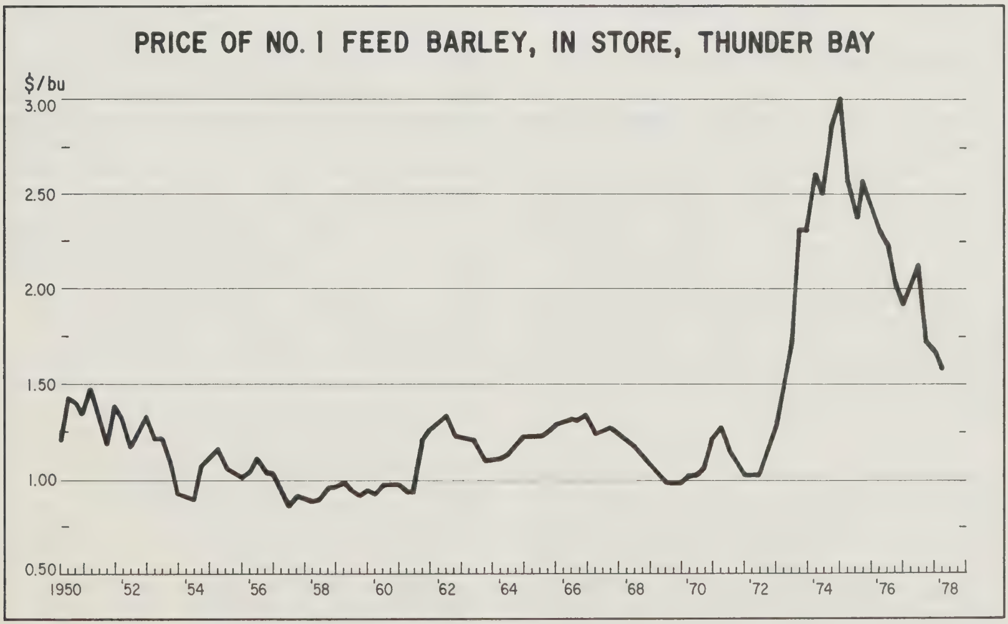

Figure 4

North America is now faced with the prospect of an extended period of sharply reduced beef supplies.

SUMMARY AND CONCLUSIONS

The preceding two sections have attempted to provide a perspective on the nature and causes of cyclical variation in the profitability of the cattle industry. It was suggested that the cattle cycle is the result of the interdependency of several cycles – cycles in cattle numbers, cattle marketings, beef supplies, and cattle prices. It was further suggested that there is an inherent tendency for self-generation of the cattle cycle, with the industry also being vulnerable to factors not pertaining directly to cattle or beef supplies. There is strong evidence that the sharp increase in feed grain prices in 1973-74 was a major contributor to the severe downturn of the most recent cycle.

It appears that finishing cattle on grain is a feature of the industry which will remain for some time. If so, the fate of the cattle industry no longer hangs exclusively on supply and demand conditions for beef, domestically or even internationally. It is now also tied closely to the fate of the international grain market. Among other things, this would indicate that attempts to stabilize the beef cycle should recognize this vulnerability.

When or if increases in feed grain prices similar in magnitude to those in 1973-74 occur again is difficult to predict, given the complex factors which cause grain price fluctuations.[11] Current attempts to stabilize the international grain market could, if successful, prevent such wide fluctuations. It can be presumed, however, that prices for feed grain will continue over the longer term to show relative strength,[12] based largely on the growth of expanded livestock feeding in many countries.

More immediately, the severity of the current inventory reduction raises serious questions about the supply and price of market cattle during the next few years. The fact that heifer slaughter did not increase as greatly as cow slaughter in previous downturns suggests that producers used periods of depressed prices partly to

[11] D. Gale Johnson, op. cit.

[12] Williard W. Cochrane, "The Price of Farm Products in the Future," *Minnesota Agricultural Economist,* Bulletin No. 589, May 1977.

PUBLICATIONS

REVIEWS

Report of the Agricultural Resources Study 1977, New Brunswick Agriculture. 189 p. *Available free, in English and French, from the Queen's Printer, P.O. Box 6000, Fredericton, New Brunswick, E3B 5H1.*

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The investigation was based on 18 rural workshops, 88 briefs, technical advice and research from independent consultants, professional staff from the governments of New Brunswick, Agriculture Canada and DREE, a farmers' advisory committee, and leaders of the agricultural and food industry.

The general objectives of the study were "... the management and utilization of the province's agricultural resources ... to maximize farm income, to strengthen the vitality of the family farm, to encourage jobs in food processing industries, and to increase food production."

The study recommended the following:

General

- Rename the Department of Agriculture and Rural Development to the Department of Agriculture and Food and make it responsible for all aspects of the development of the agricultural food system.

- Establish a senior management committee in the provincial department of agriculture.

- Give greater flexibility to the structural design of the provincial department of agriculture.

- Establish an applied research and production economics section, operate on a co-operative and supportive basis with the regional development centers, and maintain cost of production models.

Farmers' Organizations

- Strengthen the N.B. Federation of Agriculture or initiate an alternative.

- Form a joint policy group from among existing farm organizations.

Co-operative Development

- Appoint a co-operative advisory committee (by the two co-operative unions in the province).

- Each of the co-operative unions should hire an educational specialist and co-operative efforts with the Co-operative College of Canada should be explored.

- The field staff of the N.B. Department of Agriculture should pay serious attention to the follow up of co-operative education and organization.

- The N.B. Department of Agriculture and the co-operative movement should jointly determine the quality and quantity of information and educational effort to be made, prior to incorporating a co-operative.

- Financially assist new co-operatives in paying a manager's salary on a decreasing formula basis.

Regional Development Councils

- Officially recognize regional development councils (The councils have had "substantial impact.") which should operate on the basis of "programs rather than projects." The Community Improvement Association should provide support and line departments should provide support on a regional basis. Financial assistance should be provided by the provincial government for operating expenses and programs on a formula basis.

Rural Education and Human Development

- Reorganization and redirection of programs and creation of new ones.

- Continue to develop the short-course training program between the Canadian and N.B. Agricultural Manpower Training Program, with more emphasis on the needs of marginal producers, input from com-

munities, evaluation, and the use of N.S. Agricultural College staff, and provide more courses in French.

- Place more emphasis on the 4H program on agricultural projects and farm organizations and have the N.B. Institute of Agrologists take an active role.

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- The N.S. Agricultural College should be expanded to provide a degree program with pre-agriculture degree programs at respective N.B. institutions.

- Establish a school of veterinary medicine at Charlottetown, Prince Edward Island.

- Establish an institute of technology for agriculture to serve the Francophone community of New Brunswick.

Farm Management

- Give overall priority to the development of farm management skills in the extension effort. This would include counselling and programs for individuals and communities, an integrated team approach in the N.B. Department of Agriculture with regional farm management staff having input, with a core of specialists at central office providing training and co-ordination.

- That the provincial government ensure that all field staff offering farm management advice or training to farmers be adequately trained.

More recommendations of importance to the province's agriculture and food industry are provided in chapters on farm labor, technology transfer, capital, land use and control. The chapter on land use recommends the establishment of rural planning districts and the use of district planning commissions. There are chapters on land improvement and marketing. The chapter on marketing recommends the development of an effective marketing system "first and foremost" with responsibility for it going to the Farm Products Marketing Commission (FPMC) with full commitment from the Department of Agriculture. "Supply management, in its broadest sense, is the only effective route," and quotas should be the property of the FPMC, with administrative responsibility in the hands of marketing boards and criteria for quotas established by FPMC.

There are also chapters and recommendations on farm price assurance (This chapter recommends the use of production costs based on price assurance plans for slaughter beef, beef calves, fresh fruits, wheat, and barley; the maintenance of the hog stabilization program; and the formation of a farm price assurance commission to administer price assurance plans.), farmers' markets, crop insurance, transportation, energy, environmental conditions, farm woodlots, and the farm supply, forage, feed grain, dairy, beef, swine, sheep, poultry, potato, fruit and vegetable, and greenhouse industries.

Overall, this study has suggested a guideline that other provinces contemplating similar studies might use.

Agricultural Marketing Handbook, S.H. Lane, AEEE/77/8. *Available free of charge from the School of Agricultural Economics and Extension Education, Ontario Agricultural College, Ontario, Canada.*

In the foreword the author states "there has been, and there continues to be widespread public interest in the activities of marketing boards and their effect on food prices. Unfortunately much of the public discussion on these issues reflects a lack of knowledge and understanding of what marketing boards are, what they do and how they do it. One of the misconceptions that seems to be widely held is that all marketing boards are alike in purpose, structure and activities. A perusal of this publication will reveal that this is not so.

This handbook was designed to provide the user with a brief outline of the major provisions of the current federal and Ontario legislation pertaining to agricultural marketing as well as a synopsis of the structure, legislative authorities and activities of the federal and Ontario marketing boards and commissions which exercise some measure of control over the marketing and pricing of farm products. Almost all of the material concerning the legislation was taken directly from publications of the Economics Branch, Agriculture Canada. Information concerning the various marketing agencies was obtained in part from the agencies themselves and in part from published material.

The information presented is intended to provide an accurate résumé of the current administrative structure of each board and its major activities. In preparing the synopses of the marketing plans an attempt was made to present the information in a more or less uniform manner so that comparisons of the policies and programs of the different boards could be made more easily. No attempt was made to evaluate the effect or effectiveness of the boards' programs . . . ."

This handbook is a useful reference for anyone who would like to be informed on the marketing of farm products. Consumer groups and lecturers on marketing of farm products will also find this publication valuable.

Supplementary Economic Education Materials (SEEM) — A Bibliography of Free and Nominal Cost Publication. 8 p. *Available free from the Canadian Foundation for Economic Education (CFEE), 155 University Avenue, Suite 351, Toronto, Ontario, M5H 3B7, telephone (416) 862-0411, attention J. Jackson.*

This is the second SEEM edition listing a wide selection of economics related materials produced by federal and provincial government departments and agencies. These publications will be displayed at conferences, seminars and courses which the Foundation is sponsoring. The first SEEM edition focused on resource materials produced by some of the organizations supporting CFEE. CFEE is a non-profit group for the extension and advancement of understanding on economic education.

The Fourth World Food Survey. 126 pages. *Available from the Food and Agricultural Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.*

This book is a useful reference on world food production trends, malnutrition, vulnerable population groups, estimates of the magnitude of the food problem, the size of the "calorie deficit," and the inequalities in food distribution as they relate to increasing total world production.

Agriculture on Vancouver Island and the Gulf Islands. 1978, 16 p. *Available from the B.C. Ministry of Agriculture, Parliament Buildings, Victoria, B.C.*

Agricultural and Food Products Market Development Assistance Program. 1977, 20 p. *Available from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7, and Industry, Trade and Commerce, Ottawa, Ontario, K1A 0H5.*

Canadian Cattle Marketing Handbook. 1978, 84 p. *Available from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

Canadian Federal Government Services to Business. Sept. 1977, 59 p. *Available from Industry, Trade and Commerce, Ottawa, Ontario, K1A 0H5.*

Canadian Livestock Feed Board Annual Report, Crop Year 1976-77. March 31, 1978, 104 p. *Available from the Canadian Livestock Feed Board, P.O. Box 2250, St. Laurent Postal Station, Montreal, Quebec, H4L 4Y7.*

Competition and Public Policy on Competition in the Canadian Food Industry. R.M.A. Loyns, B.L. Louks (eds.), May 1977, 111 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Cooperatives and the Poor: A Review from Within the Cooperative Movement. Alexander Fraser Laidlaw, 1977, 75 p. *Available from the Canadian International Development Agency, Ottawa, Ontario, K1A 0G4.*

Dairy Price Policy: Setting, Problems, Alternatives. Alden C. Manchester, April 1978, 65 p. *Available from the U.S. Department of Agriculture, Washington, D.C., 20250.*

Economic Coordination and Growth in Fruit and Vegetable Cooperatives. William Warren Smith, Jan. 1978, 90 p. *Available from Cornell University, Ithaca, New York.*

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Farm Women. 1977, 31 p. *Available from the Saskatchewan Dept. of Labour, Saskatoon, Saskatchewan.*

Federal Farm Credit Statistics 1977. 1978, 57 p. *Available from the Farm Credit Corporation, P.O. Box 6309, Station "J", Ottawa, Ontario, K2A 3W9.*

Fifth Annual Report of the Canadian Egg Marketing Agency. March 24, 1978. *Available from the Canadian Egg Marketing Agency, 507-116 Albert Street, Ottawa, Ontario.*

Final Report of the Federal-Provincial Rural Development Review Committee. March 1978. *Available from the Department of Regional Economic Expansion, Ottawa, Ontario, K1A 0M4.*

Food – Your Best Buy. 1978, 18 p. *Available free from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

Freight Rates and the Marketing of Canadian Agricultural Products. R.M.A. Loyns, G.W. Tyrchnicwicz (eds.), Aug. 1977, 103 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Incentive and Development Programs for Canadian Industry. 1973, 28 p. *Available from Industry, Trade and Commerce, Ottawa, Canada, K1A 0H5.*

International Food Policy Issues, A Proceedings. Jan. 1978, 103 p. *Available from the Economics, Statistics and Cooperatives Services, U.S. Department of Agriculture, Washington, D.C. 20250.*

Monthly Bulletin of Agricultural Economics and Statistics. Food and Agricultural Organization of the United Nations, Dec. 1977, Volume 26, 51 p. *Available in Canada from Renouf Publishing Co. Ltd., 2182 St. Catherine St. West, Montreal, Que. H3H 1M7.*

National Farm Products Marketing Council Annual Report 1977-78. 1978, 150 p. Bilingual. *Available from the National Farm Products Marketing Council, Second Floor, Centre Building, Place de Ville, 330 Sparks St., Ottawa, Ontario, K1A 0N5.*

National Farmers Union – Submission to the Federal Cabinet on the Subject of Basic Farm Policy Issues. March 11, 1978, 15 p. *Available from the National Farmers Union.*

New Specifications for Employment and Hours Functions. T. Hazledine. Oct. 1976, 18 p. *Available from Policy & Economics Directorate, Agriculture Canada, Ottawa, Ontario, K1A 0C5.*

Perspectives Canada II – A Compendium of Social Statistics. 1977, 335 p. *Available from Statistics Canada, Ottawa, Ontario, K1A 0T6.*

Proceedings of the Agricultural and Food Marketing Forum. *Available from the Department of Agricultural Economics and Farm Management, Faculty of Agriculture, University of Manitoba, Winnipeg, Manitoba.*

Progress Report on an Outlook Model for Canadian Agricultural Inputs and Outputs. M.H. Yeh, March 1978, 142 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Report by the Tariff Board Pursuant to the Inquiry Ordered by the Minister of Finance Respecting Fresh and Processed Fruits and Vegetables; Commodity Reports: Fresh Fruits. 1977, 469 p. *Available from the Tariff Board, Ottawa, Ontario, K1A 0G7.*

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Trade and Aid, Proceedings of the Agricultural and Food Marketing Forum. R.M.A. Loyns, N.J. Beaton (eds.), Jan. 1978, 113 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

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There are also chapters and recommendations on farm price assurance (This chapter recommends the use of production costs based on price assurance plans for slaughter beef, beef calves, fresh fruits, wheat, and barley; the maintenance of the hog stabilization program; and the formation of a farm price assurance commission to administer price assurance plans.), farmers' markets, crop insurance, transportation, energy, environmental conditions, farm woodlots, and the farm supply, forage, feed grain, dairy, beef, swine, sheep, poultry, potato, fruit and vegetable, and greenhouse industries.

Overall, this study has suggested a guideline that other provinces contemplating similar studies might use.

Agricultural Marketing Handbook, S.H. Lane, AEEE/77/8. *Available free of charge from the School of Agricultural Economics and Extension Education, Ontario Agricultural College, Ontario, Canada.*

In the foreword the author states "there has been, and there continues to be widespread public interest in the activities of marketing boards and their effect on food prices. Unfortunately much of the public discussion on these issues reflects a lack of knowledge and understanding of what marketing boards are, what they do and how they do it. One of the misconceptions that seems to be widely held is that all marketing boards are alike in purpose, structure and activities. A perusal of this publication will reveal that this is not so.

This handbook was designed to provide the user with a brief outline of the major provisions of the current federal and Ontario legislation pertaining to agricultural marketing as well as a synopsis of the structure, legislative authorities and activities of the federal and Ontario marketing boards and commissions which exercise some measure of control over the marketing and pricing of farm products. Almost all of the material concerning the legislation was taken directly from publications of the Economics Branch, Agriculture Canada. Information concerning the various marketing agencies was obtained in part from the agencies themselves and in part from published material.

The information presented is intended to provide an accurate résumé of the current administrative structure of each board and its major activities. In preparing the synopses of the marketing plans an attempt was made to present the information in a more or less uniform manner so that comparisons of the policies and programs of the different boards could be made more easily. No attempt was made to evaluate the effect or effectiveness of the boards' programs . . . ."

This handbook is a useful reference for anyone who would like to be informed on the marketing of farm products. Consumer groups and lecturers on marketing of farm products will also find this publication valuable.

Supplementary Economic Education Materials (SEEM) — A Bibliography of Free and Nominal Cost Publication. 8 p. *Available free from the Canadian Foundation for Economic Education (CFEE), 155 University Avenue, Suite 351, Toronto, Ontario, M5H 3B7, telephone (416) 862-0411, attention J. Jackson.*

This is the second SEEM edition listing a wide selection of economics related materials produced by federal and provincial government departments and agencies. These publications will be displayed at conferences, seminars and courses which the Foundation is sponsoring. The first SEEM edition focused on resource materials produced by some of the organizations supporting CFEE. CFEE is a non-profit group for the extension and advancement of understanding on economic education.

The Fourth World Food Survey. 126 pages. *Available from the Food and Agricultural Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.*

This book is a useful reference on world food production trends, malnutrition, vulnerable population groups, estimates of the magnitude of the food problem, the size of the "calorie deficit," and the inequalities in food distribution as they relate to increasing total world production.

Agriculture on Vancouver Island and the Gulf Islands. 1978, 16 p. *Available from the B.C. Ministry of Agriculture, Parliament Buildings, Victoria, B.C.*

Agricultural and Food Products Market Development Assistance Program. 1977, 20 p. *Available from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7, and Industry, Trade and Commerce, Ottawa, Ontario, K1A 0H5.*

Canadian Cattle Marketing Handbook. 1978, 84 p. *Available from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

Canadian Federal Government Services to Business. Sept. 1977, 59 p. *Available from Industry, Trade and Commerce, Ottawa, Ontario, K1A 0H5.*

Canadian Livestock Feed Board Annual Report, Crop Year 1976-77. March 31, 1978, 104 p. *Available from the Canadian Livestock Feed Board, P.O. Box 2250, St. Laurent Postal Station, Montreal, Quebec, H4L 4Y7.*

Competition and Public Policy on Competition in the Canadian Food Industry. R.M.A. Loyns, B.L. Louks (eds.), May 1977, 111 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Cooperatives and the Poor: A Review from Within the Cooperative Movement. Alexander Fraser Laidlaw, 1977, 75 p. *Available from the Canadian International Development Agency, Ottawa, Ontario, K1A 0G4.*

Dairy Price Policy: Setting, Problems, Alternatives. Alden C. Manchester, April 1978, 65 p. *Available from the U.S. Department of Agriculture, Washington, D.C., 20250.*

Economic Coordination and Growth in Fruit and Vegetable Cooperatives. William Warren Smith, Jan. 1978, 90 p. *Available from Cornell University, Ithaca, New York.*

The Effects of Monetary Change on Relative Commodity Prices. Michael David Bordo, 1978, 34 p. *Available from Carleton University, Ottawa, Ontario.*

The Eleventh Annual Report of the Canadian Transport Commission 1977. 1978, 140 p. *Available from the Canadian Transport Commission, Ottawa, Ontario, K1A 0N9.*

Energy and the Food System. Dec. 1977, 142 p. *Available from the Food Production and Marketing Branch, Agriculture Canada, Ottawa, Ontario, K1A 0C5.*

Farm Credit Corporation Annual Report 1977-78. June 16, 1978, 32 p., Bilingual. *Available from the Farm Credit Corporation, P.O. Box 6309, Station "J", Ottawa, Ontario, K2A 3W9.*

Farm Women. 1977, 31 p. *Available from the Saskatchewan Dept. of Labour, Saskatoon, Saskatchewan.*

Federal Farm Credit Statistics 1977. 1978, 57 p. *Available from the Farm Credit Corporation, P.O. Box 6309, Station "J", Ottawa, Ontario, K2A 3W9.*

Fifth Annual Report of the Canadian Egg Marketing Agency. March 24, 1978. *Available from the Canadian Egg Marketing Agency, 507-116 Albert Street, Ottawa, Ontario.*

Final Report of the Federal-Provincial Rural Development Review Committee. March 1978. *Available from the Department of Regional Economic Expansion, Ottawa, Ontario, K1A 0M4.*

Food – Your Best Buy. 1978, 18 p. *Available free from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

Freight Rates and the Marketing of Canadian Agricultural Products. R.M.A. Loyns, G.W. Tyrchnicwicz (eds.), Aug. 1977, 103 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Incentive and Development Programs for Canadian Industry. 1973, 28 p. *Available from Industry, Trade and Commerce, Ottawa, Canada, K1A 0H5.*

International Food Policy Issues, A Proceedings. Jan. 1978, 103 p. *Available from the Economics, Statistics and Cooperatives Services, U.S. Department of Agriculture, Washington, D.C. 20250.*

Monthly Bulletin of Agricultural Economics and Statistics. Food and Agricultural Organization of the United Nations, Dec. 1977, Volume 26, 51 p. *Available in Canada from Renouf Publishing Co. Ltd., 2182 St. Catherine St. West, Montreal, Que. H3H 1M7.*

National Farm Products Marketing Council Annual Report 1977-78. 1978, 150 p. Bilingual. *Available from the National Farm Products Marketing Council, Second Floor, Centre Building, Place de Ville, 330 Sparks St., Ottawa, Ontario, K1A 0N5.*

National Farmers Union – Submission to the Federal Cabinet on the Subject of Basic Farm Policy Issues. March 11, 1978, 15 p. *Available from the National Farmers Union.*

New Specifications for Employment and Hours Functions. T. Hazledine. Oct. 1976, 18 p. *Available from Policy & Economics Directorate, Agriculture Canada, Ottawa, Ontario, K1A 0C5.*

Perspectives Canada II – A Compendium of Social Statistics. 1977, 335 p. *Available from Statistics Canada, Ottawa, Ontario, K1A 0T6.*

Proceedings of the Agricultural and Food Marketing Forum. *Available from the Department of Agricultural Economics and Farm Management, Faculty of Agriculture, University of Manitoba, Winnipeg, Manitoba.*

Progress Report on an Outlook Model for Canadian Agricultural Inputs and Outputs. M.H. Yeh, March 1978, 142 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Report by the Tariff Board Pursuant to the Inquiry Ordered by the Minister of Finance Respecting Fresh and Processed Fruits and Vegetables; Commodity Reports: Fresh Fruits. 1977, 469 p. *Available from the Tariff Board, Ottawa, Ontario, K1A 0G7.*

Retention of the Crow Rate and the Alberta Livestock Economy. Dr. G.A. MacEachern, April 1978, 58 p. *Available from the Agricultural Economics Research Council of Canada, 1007-100 Bronson Avenue, Ottawa, Ontario.*

A Review of Research on the Canadian Food Industry. Nov. 1977, 150 p. *Available from Consumer and Corporate Affairs Canada, Place du Portage, Hull, Quebec.*

Rural to Urban Conversion. D.M. Gierman, 1977, 74 p. *Available from Fisheries and Environment Canada, Ottawa, Ontario, K1A 0H3.*

Saskatchewan Farm Women; A Resource in Need of Recognition. Lynne Pearson, Jan. 11, 1978, 14 p. *Available from the University of Saskatchewan, Saskatoon, Saskatchewan.*

Technical and Scientific Papers Presented at the Manitoba Agronomists' Annual Conference. Dec. 13-14, 1977, 130 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

Time Management in Farming. Feb. 1978, 14 p. *Available from the Extension and Rural Development Division, Saskatchewan Agriculture, Regina, Saskatchewan.*

Trade and Aid, Proceedings of the Agricultural and Food Marketing Forum. R.M.A. Loyns, N.J. Beaton (eds.), Jan. 1978, 113 p. *Available from the University of Manitoba, Winnipeg, Manitoba.*

IN REPLY

Note to Readers: We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we'll try to accommodate you.

When forwarding your "In Reply" or letter, indicate if we may publish your comments in a subsequent issue.

We were pleased to receive a letter from the Agricultural Institute of Canada requesting 40 copies of our April issue for special distribution. An Agriculture Canada engineer also required 12 copies of an article for use at a special meeting. Requests for extra copies of CFE or certain articles can be made to the editors or to A. Trempe, Publications Distribution Manager.

Frank Hanus, economist, 19 Larkspur Crescent, St. Albert, Alberta, wrote that all of the February issue was a useful and "straightforward handling of the issues" and that he was very pleased with the issue.

Gord Wainman, farm reporter, London Free Press, 369 York Street, London, Ontario, said that the article on farm debt in Canada backed up statistically what a number of farm spokesmen had said and that the article was very useful.

Linley Shelton, student, 2026 Stainsbury Avenue, Vancouver, British Columbia, wrote that "It was interesting to see that the government's role in protecting both farmer and consumer has been to promote more indebtedness to large financial conglomerates." He also referred to personal loans and for what purposes money was borrowed. The author, A.S. Brunst, provided the following reply to Mr. Shelton:

> The appreciation in the value of farm land and buildings during the period 1971-1976 was substantial as shown in Table 5 of the article; in addition, farm machinery prices also showed marked increases. Consequently, the acquisition of farm real estate or machinery required greater capital in recent years as compared to the early seventies. Thus even if the proportion of capital purchases financed through borrowings remained constant during this period, the dollar value of debt outstanding would have shown substantial increases, given that the volume of transactions did not decline. Inflation certainly played a role in the foregoing, as part of the increase in farm real estate and machinery during this period could be attributed to this phenomenon. As regards farm operating loans, these would tend to increase as the cost of farm inputs increased. During the period 1970-1976 many inputs, such as fertilizers, pesticides, feed, etc., increased substantially in price; see Farm Input Price Index, Statistics Canada, Catalogue No. 62-004, quarterly. Here again, part of these price increases could be attributed to inflation and certainly the price increases lead to increases in the dollar value of borrowings for farm operating purposes.
>
> Turning to your question on interest rates trends, perhaps I can help by providing rates charged by the Farm Credit Corporation under the Farm Credit Act, and Chartered Banks' prime lending rates during the period 1970-1976.

		Farm Credit Corporation	Chartered Banks
Date		rates reviewed semi-annually	prime lending rate, average of monthly rates
		– percent	–
1970	April 1	$7^3/_4$	8.17
	October 1	$7^1/_2$	
1971	April 1	$6^3/_4$	
	October 1	$6^1/_2$	6.48
1972	April 1	6	
	October 1	6	6.00
1973	April 1	6	
	October 1	6	7.65
1974	April 1	$7^1/_4$	
	October 1	$8^1/_4$	10.75
1975	April 1	$7^1/_2$	
	October 1	8	9.40
1976	April 1	$8^3/_4$	
	October 1	9	10.10

A letter from L. Bomford, farm management consultant, B.C. Ministry of Agriculture, stated that the article on farm debt in Canada provided him with the first information on recent cash expenses that groups B.C. farmers in categories that are comparable with grain farmers elsewhere.

Philip P. Weatherald, farmer, Wawota, Saskatchewan, said that the issue was very useful and provided a mean

with which to compare his own operation and an indication as to the direction that his enterprise was heading. He would have liked to have seen 1977 data included, but these data were not available to the author.

Rand C. Luthning, agricultural specialist, Saskatchewan Power Corporation, Regina, Saskatchewan, said that he was undertaking a similar survey on business organization and growth patterns of farms in Saskatchewan. He found many interesting concepts in Johnson's article.

Brian Freeze, agricultural economist, Veterinary Infectious Diseases Organization, University of Saskatchewan, Saskatoon, wrote that he was particularly interested in the article on variation in cash expenses on western grain farms. Also, the articles on farm debt in Canada and on business organization and growth patterns in Saskatchewan had relevance to his data concerns in a beef-forage-grain model.

R.N. Plank, assistant regional manager, Farm Credit Corporation, Kelowna, British Columbia, said the article on farm debt was useful. He would like to see an analysis of farm debt where sales of agricultural products provided 51 percent or more of total family income and a comparison of debt with the age of the operator.

Sohel Zariffa, economist, Montreal, said he used the article on farm debt to compare the financial health of Quebec's agriculture with other provinces.

He asked why Quebec has the lowest increase in capital value from 1971 to 1976 and the highest debt investment ratio among all provinces. A.S. Brunst replied as follows:

> There are several theories that I could develop to account for the questions you raised; however, I feel that they would be of a rather subjective nature and therefore I would prefer to leave this to you. However, from an objective standpoint, one important factor to consider would be the decline in total farmland in Quebec between the period 1971-1976 from 10,801,116 to 9,906,319 acres as reported in the findings of the 1976 Census of Agriculture. This decline of 8.3 percent was much greater than the decrease in evidence at the Canada level of 0.4 of 1 percent and probably explains why Quebec showed the smallest increase in capital value during 1971-1976. This phenomenon also no doubt accounts to some extent for Quebec retaining its position of having the highest debt-investment ratio among the provinces in 1976.

ERRATUM

In the June 1978 issue, Vol. 13, No. 3, page 16, second column, first line, "exclusive of taxes" should be "inclusive of taxes."

IN REPLY TO AUTHORS AND EDITORS REGARDING AUGUST 1978 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) Canada's Agricultural Trade – Recent Developments and Export Prospects
(2) A Profile of the General Agreement on Tariffs and Trade
(3) Some Observations on the Cattle Cycle in Canada

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?
   not useful 1 2 3 4 5 6 7 8 9 10 very useful

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr. or Ms.) ______________________ Occupation ______________
(Please Print)

ADDRESS ____

Please return the above to:

John McConnell, Managing Editor, Canadian Farm Economics
Information Division
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
Canada
K1A 0C5

CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	millimetre	(mm)
foot	x 30	centimetre	(cm)
yard	x 0.9	metre	(m)
mile	x 1.6	kilometre	(km)
AREA			
square inch	x 6.5	square centimetre	(cm^2)
square foot	x 0.09	square metre	(m^2)
acre	x 0.40	hectare	(ha)
VOLUME			
cubic inch	x 16	cubic centimetre	(cm^3)
cubic foot	x 28	cubic decimetre	(dm^3)
cubic yard	x 0.8	cubic metre	(m^3)
fluid ounce	x 28	millilitre	(ml)
pint	x 0.57	litre	(ℓ)
quart	x 1.1	litre	(ℓ)
gallon	x 4.5	litre	(ℓ)
WEIGHT			
ounce	x 28	gram	(g)
pound	x 0.45	kilogram	(kg)
short ton (2000 lb)	x 0.9	tonne	(t)
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius	(°C)
PRESSURE			
pounds per square inch	x 6.9	kilopascal	(kPa)
POWER			
horsepower	x 746	watt	(W)
	x 0.75	kilowatt	(kW)
SPEED			
feet per second	x 0.30	metres per second	(m/s)
miles per hour	x 1.6	kilometres per hour	(km/h)
AGRICULTURE			
gallons per acre	x 11.23	litres per hectare	(ℓ/ha)
quarts per acre	x 2.8	litres per hectare	(ℓ/ha)
pints per acre	x 1.4	litres per hectare	(ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare	(ml/ha)
tons per acre	x 2.24	tonnes per hectare	(t/ha)
pounds per acre	x 1.12	kilograms per hectare	(kg/ha)
ounces per acre	x 70	grams per hectare	(g/ha)
plants per acre	x 2.47	plants per hectare	(plants/ha)

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VOLUME 13 NUMBER 5 OCTOBER 1978

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. EUGENE WHELAN, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

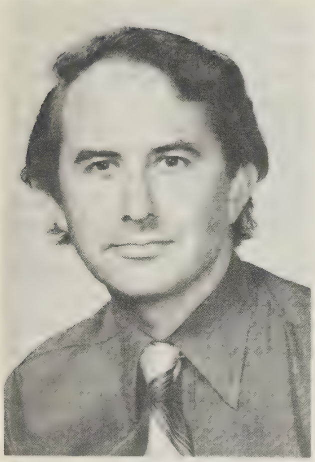
CANADIAN FARM ECONOMICS (CFE) is published bi-monthly by Information Services, Canada Department of Agriculture, Sir John Carling Building, Ottawa, and is based on material prepared by members of the Policy, Planning and Economics Branch.

Purpose: To provide current information on agricultural economics to agricultural economists, decision makers, researchers, extension workers, farm mass media serving farmers and the agricultural food industry, leading farmers, farm organizations, agri-business groups, librarians, and offices abroad. CFE should be understandable to the majority of those on the mailing list.

Subscription: There is no charge for a subscription. To receive this publication regularly, write a letter to the Publications Manager asking to be placed on the mailing list. Send to Room 303, Policy, Planning and Economics Branch, Agriculture Canada, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.

Letters from readers: Letters are encouraged and should be addressed to the editor. Comments and suggestions are useful to editors and authors for effective two-way communication. Edited letters will be used in CFE with the writer's permission.

MANAGEMENT FOR INCREASED PRODUCTIVITY IN DAIRY FARMING



S.C. Thompson*

This paper illustrates the possible impact of improved technology on regional agricultural resources currently used in dairy farming.

A national average milk yield per cow of 4,850 litres a year could be attained by improved feeding methods, calving interval reductions, and artificial insemination. A projected demand for 64.7 million hectolitres of milk in 1983 could be met by a national herd of 1.35 million cows, three-quarters of a million less than the 1975 herd. If productivity in labor use and crop production is assumed not to change, approximately 1.8 million hectares of land and 17,000 man-years of labor could be made available for other enterprises.

THE STRUCTURE OF DAIRY PRODUCTION IN CANADA

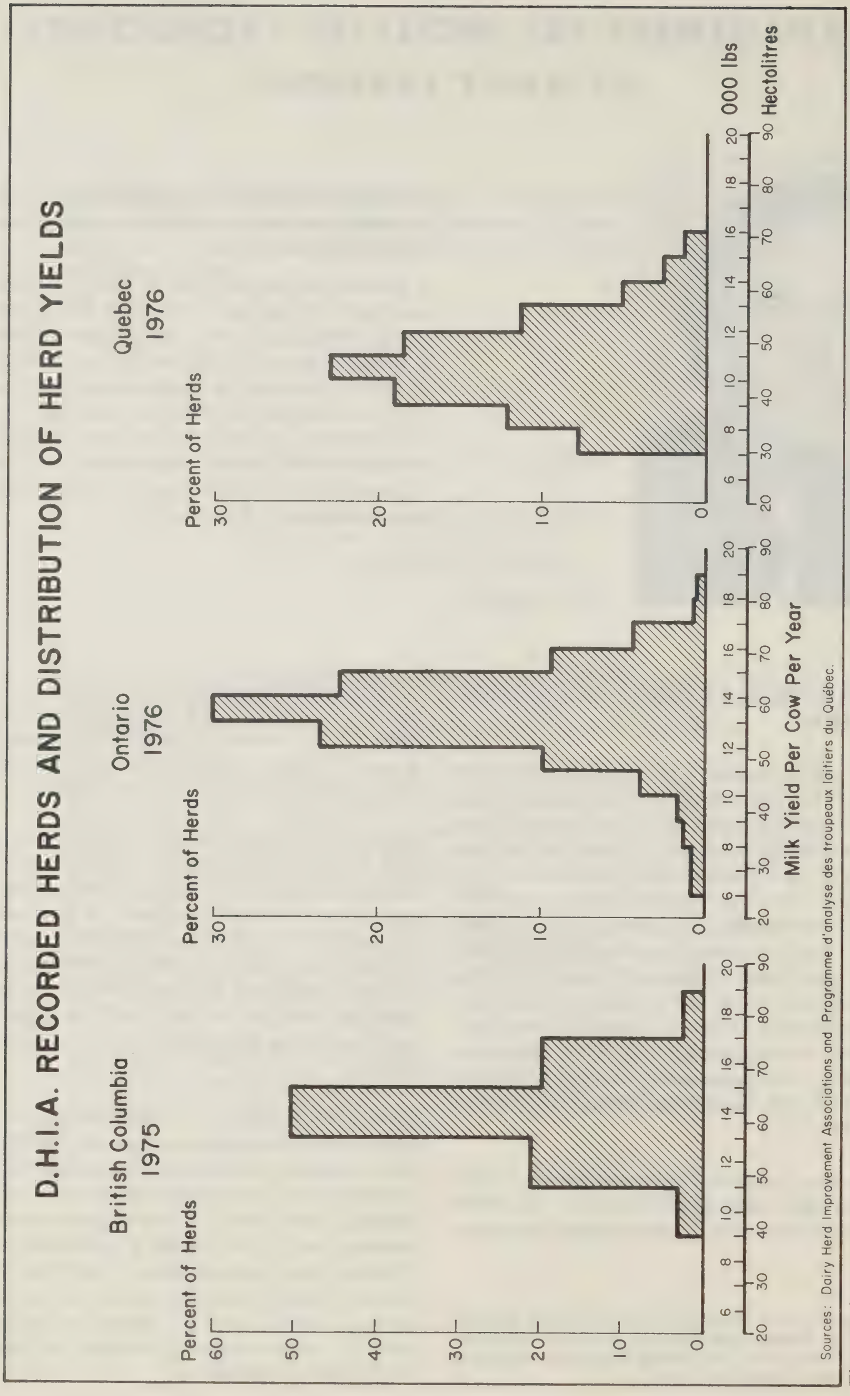
About 75 million hectolitres of milk were marketed in Canada in 1975. This milk was produced by 2.1 million cows in a total dairy herd of five million animals on 81,000 commercial dairy farms. The dairy herd provides 25 percent of the beef consumed in Canada; and sales of milk, veal, and dairy cow beef from dairy farms in 1975 totalled 1.9 billion dollars, 19 percent of the total farm income in Canada. Income from milk sales was the most important single source of farm cash receipts in Quebec, Ontario, British Columbia, and Nova Scotia. The demand for dairy products, except for specialty cheeses and some other specialty products, is slowly decreasing. Consequently, total consumption of dairy products is expected to decline from current levels 1 to 2 percent a year by 1983.

There has been a gradual trend across Canada towards fewer dairy farms with larger herds. The 1951 census showed 455,000 farms in Canada reporting dairy cows, but this number had dropped to 145,000 by 1971. Yield per cow in Canada rose from 2,107 litres in 1950 to 3,484 in 1975. British Columbia had the highest yield at about 4,976 litres a cow, while Ontario averaged 4,144 litres, Quebec 2,719, and the United States 4,275.

Projections of current trends to 1983 predict a national herd of 1.75 million cows in 40,000 herds, with a national average of 44 cows per herd yielding 3,740 litres a year. This rapid adjustment in herd numbers is expected to cause severe adjustment problems in Quebec, which produces nearly half of Canada's manufacturing milk, has the most to gain in terms of increasing yields per cow, and unlike the Prairie region, has fewer farming alternatives to offer its out-going dairy farmers.

Canadian dairy production is based primarily on forages grown on class 3 and 4 land not generally suited to other crops. Forages are estimated to provide for animal maintenance and approximately 1,000 litres of milk per lactation. Above this level concentrates are fed at an estimated rate of one kilogram of concentrate for every 2.4 litres of milk produced. As such, yearly consumption of concentrates by the dairy herd averages 2.2 million tonnes, of which about 1.7 million are feed grain. A further 0.7 million tonnes of feed grain are assumed to be fed to dairy replacements.

*S.C. Thompson is the former head of Bio-Economic Research in the Policy, Planning and Evaluation Branch of Agriculture Canada in Ottawa. He is now Deputy Director of Agriculture Canada's Animal Research Institute.



Sources: Dairy Herd Improvement Associations and Programme d'analyse des troupeaux laitiers du Québec.

Figure 1

The dairy enterprise is labor intensive and requires about 80 man-hours per cow a year, including the time required for care of replacement animals. On top of this, approximately 30 man-hours per cow are needed for growing the necessary forage and feed grains.

Each dairy cow (including replacements) requires an average of 0.4 hectares of land for grain crops, 0.8 hectares of pasture, and 1.2 hectares of forages for hay and silage. The total dairy industry land base is 5.1 million hectares, and an estimated 6.5 billion dollars is invested in this land base. Total capital investment per dairy cow in 1975 was estimated at $3,000: $1,600 for land, $450 for livestock (rising to $700 in 1977), and $950 for buildings and equipment.

PRODUCTIVITY INDICATORS IN DAIRYING

Increased milk output per cow each year is the productivity measure most widely accepted as an indicator of profitability, and its use rests on the assumption that the majority of producers is operating below the point on the production curve where marginal returns equal marginal costs. Thus within certain limits, measures to increase production per cow should result in higher profit margins at the farm level. Table 1 shows yields per cow in nine provinces for 1974 to 1976.

Yields vary widely from the average in each province, and recent Dairy Herd Improvement Association (D.H.I.A.) herd records for British Columbia, Ontario, and Quebec show spreads of about 2,200 litres on either side of their means (Figure 1). D.H.I.A. records, however, represent a biased sample of dairy farmers, since sample average yields are 25, 40, and 55 percent above respective provincial averages in British Columbia, Ontario, and Quebec. Moreover, the use of herd average yields has masked a portion of the variation which might be ascribed to differences between individual cows.

Two other indicators of productivity – calving interval and seasonality of production – are closely related to annual milk yield. The further the interval between successive calvings is allowed to slip beyond a twelve-month cycle, the lower will be annual production. Figure 2, for example, illustrates that most D.H.I.A. herds in Ontario average over 13 months between calvings. D.H.I.A. recorded herds are likely to be better managed than the average, hence the Ontario interval might be longer than Figure 2 suggests.

Most industrial milk production in Canada follows the grazing season, so that the ratio of summer to winter industrial milk is approximately 70:30, a ratio which compares favorably with 80:20 in New Zealand, but unfavorably with 52:48 in the United States. Increasing production by extending the production season would thus have an important side-effect of smoothing milk deliveries to plants.

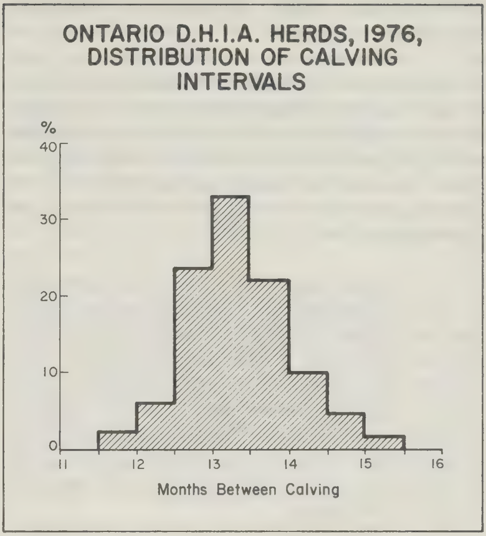


Figure 2

TABLE 1. AVERAGE MILK PRODUCTION PER COW[a]

Area	1974	1975[b]	1976[b]
		litres	
Newfoundland	–	–	–
Prince Edward Island	3,533	3,225	3,441
Nova Scotia	3,452	3,669	3,963
New Brunswick	3,139	3,278	3,385
Quebec	2,950	2,719	2,947
Ontario	3,897	4,144	4,242
Manitoba	3,169	3,285	3,397
Saskatchewan	3,209	2,900	3,229
Alberta	3,679	3,477	3,804
British Columbia	5,012	4,976	5,070
Canada	3,438	3,484	3,528

[a] A cow as defined here is a cow milked during the year.
[b] Series revised in 1975.

Source: Statistics Canada, Dairy Review.

POTENTIAL FOR IMPROVED PRODUCTIVITY

Yield projections for 1983 at the current rate of yield advance suggest a national average yield of 3,740 litres, about 8 percent above the 1975 level. In comparison, milk producers in the northern U.S. states bordering Canada are already achieving a uniform 4,560 litres, with the exceptions of North Dakota at 3,450 litres and Washington at 5,610.

D.H.I.A. records show that yields considerably above present provincial averages can be achieved by improved husbandry techniques. If all herds were to reach current D.H.I.A. averages by 1983, a national average of 4,850 litres per cow would be attainable. There is some recent evidence from Canfarm that dairy farmers are the fastest growing group of clients for management aids, and achievement of D.H.I.A. norms within five years appears a realistic goal, though further potential will remain for increased productivity.

NEW TECHNOLOGY IN DAIRYING

Attainment of a 4,850-litre average yield by 1983 implies an acceleration of current yield improvements from 1 percent a year to 5 percent. Much of this increase can be achieved by improved management and husbandry techniques, and need not involve acquisition of new buildings or equipment – though there will still remain scope for increased labor productivity by greater attention to the design of milking and feeding routines.

There are three technology-based programs which could be coordinated with the D.H.I.A., Record of Production (R.O.P.), and others to form a coherent dairy development program. The first, Canfarm's dairy nutrition package, can reduce feeding costs $100 per cow each year at constant output and can be used to explore ways of increasing output. The second, a program of artificial insemination, can increase yields per cow and reduce the calving interval when used with improved feeding systems. The third, mastitis control, can increase milk yields 5 to 10 percent.

Canfarm's dairy feed formulation service calculates low cost, nutritionally balanced rations based on grain and mineral mixes to balance the farmer's own home grown feeds. Some feed mills are also using the service to formulate commercial dairy rations. Separate rations are calculated for dry cows and for milking cows at eight different levels of daily milk production, and the calculations account for the cow's size and her butterfat production as well as her milk production. Experience with the service has led to the following general recommendations:

- reduced feed intake by dry cows,
- reduced feed for low producers and cows near the end of lactation,
- increased feed for high producers and cows in early lactation,
- a higher proportion of forage for low yielders, and
- a higher proportion of concentrates for high yielders.

The cost saving of balanced rations is likely to be 3 or 4 percent. The major benefit, however, comes in increased feeding of high producers in the first six weeks of lactation until the peak yield is reached. A high peak yield means that yield will remain higher than normal for the rest of the lactation, even if the feeding rate is reduced after the peak. Extension agents are reporting typical yield increases of 600 litres a cow per year with no extra feed required for the herd as a whole. Correct ration formulation can also reduce the calving interval for cows inseminated both naturally and artificially.

A widespread problem with artificial insemination is the cow's failure to conceive at first service, with many cows taking three services before conceiving. Cows are normally dried off around the 305th day of lactation, and infertility costs $1.50 in lower milk production for every day that the lactation is extended beyond this time. Correct feeding can increase fertility levels so that fewer services are required to get a cow in calf. Canfarm's experience has been that mineral balance is particularly important in certain areas, and some Ontario farmers who use the service are reporting 80 percent success on the first service instead of 40 percent. If the herd should show improvement by one heat cycle of 21 days, then the net saving would amount to $31.50 a cow per year, with an increased milk yield of 200 litres per cow. Improved fertility should also reduce present culling rates of approximately 26 percent to 19 percent, with an annual saving averaging $26 per cow.

Artificial insemination (A.I.) can increase genetic yield potential by up to 300 litres of milk per cow, though an increased feed intake would be necessary to achieve this potential. About 80 percent of D.H.I.A. herds use A.I. and are now showing diminishing returns at approximately 50 litres per cow (2). However, about half of the national herd does not receive A.I., and a 100-litre average improvement by 1983 would be a realistic target.

Mastitis remains the major disease of economic concern. Half of the dairy herd is estimated to have sub-clinical

mastitis, and this results in a 5- to 10-percent drop in milk yield. The disease is more of a problem in high-yielding cows and situations in which the cowman is pressed for time, but new developments in detection and control show promise of eventually eliminating mastitis if they are applied throughout the industry. A yield increase of 100 litres per cow by 1983 is quite possible.

Hence improved ration balancing and mastitis control can produce a yield increase of 700 litres per cow with no increase in the total feed required. A reduction in the calving interval contributes 200 litres to the annual milk yield and breed improvement contributes another 100, but both require timely and more intensive feeding. Further intensive feeding (mainly of grain) would be required to increase the national average yield a final 366 litres to reach a 1983 average of 4,850 per cow. Thus intensification, as distinct from technological advance, would require an increased annual feed intake of 280 kilograms of concentrate per cow. This overall milk increase of 1,366 kilograms per cow implies an increased efficiency of feed use so that, at a 4,850-litre yield level, one kilogram of feed will provide 2.9 litres of milk instead of 2.4.

One major consequence of the three programs would be to force a reconsideration of the farm cropping program. Increased production per cow will imply relatively less dependence on five or six months of summer pasture as more milk is produced in winter. A recent Quebec study has confirmed that extending the lactation period on either side of the pasture season can increase returns per cow by $100 after allowing for increased feed costs. Milk deliveries will thus spread into the winter period, necessitating more effective forage conservation methods.

BENEFITS AND COSTS AT FARM LEVEL

To increase their productivity, farmers would be faced with four main choices: to increase production by enlarging the herd, to maintain current production from a reduced herd, to increase production from the present herd, or to move out of dairying. The latter two are examined here.

Increasing production by 1,366 litres to 4,850 litres per cow from the present herd would require an extra 280 kilograms of concentrate per cow, adherence to an improved feeding system, improved mastitis control, and A.I. Labor requirements could increase from 80 hours per cow to approximately 94 hours to cope with the greater milk output, and closer supervision of each cow. A farmer with 35 cows currently shipping 3,500 litres per cow would need to find 490 more man-hours per year and 47,800 litres of quota besides the 122,500 litres he owns. Other costs would include the price of the A.I. services, any fee for feed formulation, and the milk storage he would need to ship an extra 155 litres a day from his herd. Most of the benefit would of course come from increased milk sales, though a net saving would also accrue if the culling rate were to be reduced. A partial budget of the change at the individual cow and herd level is in Table 2.

Much of the revenue increase of $7,470 for a 35-cow herd would be bid away if individual farmers had to compete with others in purchasing the necessary extra quota. In a perfectly free market, the price a farmer would be willing to pay would exactly nullify the gains he expected to make. Quota price for the situation above could approach 55 cents a litre, compared with recent prices in some provinces of 3 to 30 cents a kilogram. At 55 cents a litre, the extra quota would cost $26,000 and represent the major adjustment cost facing a farmer. In practice, however, quota prices are influenced by risk discounting which might reduce the theoretical market price, and several provinces operate to regulate free trade in quota.

The partial budget in Table 2 assumes that the labor requirement must increase to handle the extra milk.

TABLE 2. PARTIAL BUDGET FOR A 35-COW HERD INCREASING YIELD FROM 3,484 TO 4,850 LITRES PER COW (1977 CONSTANT PRICES)

Income and Costs	Per Cow	Per Herd (x35)
	$	
New Income		
1,366 1 extra milk, $22.25/hl	304	10,630
Costs Saved		
.07 replacement cows at $700	49	1,715
	353	12,345
Income Foregone		
.07 cull cows at $325	23	805
New Costs		
280 kg 16% dairy ration at $.13/kg	37	1,270
14 hours labor at $4	56	1,960
A.I.	10	350
Feed formulation	–	–
Extra milk storage	14	490
	140	4,875
Net Revenue from Change (if extra quota were free)	213	7,470

Present milk production levels on a 35-cow farm growing its own feeds demand a 70-hour week without any allowance for management and planning functions, and increased milk output could increase this to a 77-hour week. In these conditions more intensive use of capital (involving $20,000 or more per farm) is the common method of reducing the labor requirement per cow.

Those farmers who are unable to increase dairy productivity will eventually face higher real unit costs. Lower net returns than those of their more efficient neighbors and a higher quota price might encourage some producers to leave the dairy industry, thereby releasing quota for farmers who wish to expand. The retirement rate from dairying will depend on alternative opportunities and adjustment factors prevailing on a particular farm, but the sale of cull cows and their accompanying quota should provide a useful financial base from which to launch a new enterprise. For example, a farmer selling 25 cows and quota at 1977 prices would expect to realize over $35,000.

NATIONAL AND REGIONAL RESOURCE IMPACT

As a first approximation of the national and regional impacts of an increase in milk yield, some gross estimates of resource changes can be made under the restrictive assumption that input prices will not change.

At the national level, an increase of 1,366 litres in average milk production per cow to 4,850 by 1983, with a projected demand for 64.7 million hectolitres, would require a national herd of 1.35 million cows (about three quarters of a million smaller than the 1975 herd) and 1.85 million replacements. The dairy herd's size has been decreasing since 1950 at a rate of 40,000 cows a year, but a 1983 herd of 1.35 million would require the exit rate to be more than doubled by a combination of lower replacement rate and an initially higher culling rate.

At current feeding rate, the feed grain requirement for milking cows would drop from its 1975 level of 1.7 million tonnes to 1.1 million. More intensive use of concentrates to achieve a 4,850 litre yield, however, will require an additional 0.3 million tonnes of feed grain for a total of 1.4 million tonnes. Feed grain requirements for replacement cows are assumed to remain at an average of 240 kilograms a head, and aggregate requirements for the smaller national replacement herd would drop from 0.7 million tonnes to 0.45 million. Thus national grain requirement for cows and replacements would fall from 2.4 to 1.85 million tonnes. In summary, the feed grain area required for dairy cows would drop from 0.85 million to 0.65 million hectares. Forage area would be reduced from 2.5 to 1.6 million hectares, and pasture needs would drop from 1.7 to 1 million hectares.

Labor use in dairying would also decline from the present 68,000 man-years used directly in milking, feeding, and manure disposal to 51,000. If, however, capital substitution were to maintain labor use at its current level of 80 hours a cow despite increased yields, then the labor force devoted exclusively to dairying would shrink to 43,000 man-years, less than two thirds of current requirements.

Average investment in buildings and equipment was $950 a cow in 1975, or $33,000 for a 35-cow herd. Modernized buildings necessary to increase labor productivity could cost over $20,000 for a farm of 35 cows, and a national modernization program could cost $500 million spread over several years. Adoption of modern buildings, such as herringbone parlors for larger herds, would cause an upsurge in the dairy buildings industry, and would also facilitate the more precise feeding of cows necessary to obtain higher yields.

More detailed statistics on regional feeding systems for dairy cattle are needed before a thorough breakdown of the regional impacts of increased dairy productivity can be calculated. Table 3, however, sets out some gross estimates of provincial impacts. The simplifying assumption has been made that dairy cows in every province can use 280 kilograms of concentrate to achieve a 1,366-litre increase in milk yield over their 1975 production levels, regardless of the actual level achieved in 1975. The resultant "target" yields for each province are summarized in Table 3, accord well with D.H.I.A. average yields in Figure 1, and carry an element of diminishing marginal productivity in that cows yielding 2,700 litres would experience a 50-percent increase in yield, while cows yielding 5,000 litres would increase output only 27 percent. Again, for simplicity, an assumption is made that dairy cows in every province have a feed intake of forage and pasture to provide for maintenance plus 1,000 litres of milk per lactation, while the remainder is provided from dairy concentrate. The labor requirement for dairying (excluding the growing of associated crops) has been calculated under the assumption that capital will not be substituted for labor. A final assumption is that all provinces retain their present share of market quota, so that national distribution of quota is not affected.

TABLE 3. PROVINCIAL RESOURCE IMPACT OF A COUNTRY-WIDE MILK YIELD INCREASE OF 1,366 1 PER COW OVER 1975 YIELDS

Area	Milk Yield per Cow		No. of Cows		Feed Grain per Cow in Milk		Feed Grain per Province		Labor in Dairying	
	1975[a]	1983	1975[b]	1983	1975	1983	1975	1983	1975	1983
	— litres —		— '000 —		— kg —		— '000 tonnes —		— man-years —	
Newfoundland	—	—	—	—	—	—	—	—	—	—
Prince Edward Island	3,225	4,591	27	17	712	928	29	22	860	645
Nova Scotia	3,669	5,035	40	26	853	1,069	49	37	1,275	960
New Brunswick	3,278	4,644	32	20	700	916	34	26	1,020	765
Quebec	2,719	4,085	950	556	552	768	874	635	30,250	22,690
Ontario	4,144	5,510	640	440	1,003	1,219	888	709	20,375	15,280
Manitoba	3,285	4,651	102	64	730	946	112	854	3,250	2,440
Saskatchewan	2,900	4,266	85	51	610	826	83	60	2,700	2,025
Alberta	3,477	4,843	170	108	792	1,008	198	148	5,400	4,050
British Columbia	4,976	6,342	90	63	1,266	1,482	150	120	2,830	2,120
Canada	3,484	4,850	2,136	1,345	794	1,010	2,417	1,842	68,000	51,000

[a]From *Dairy Review,* Statistics Canada, Catalogue No. 23-001.
[b]From *Report on Livestock Surveys,* Statistics Canada, Catalogue No. 23-004.

All columns in Table 3, except milk yields and cow population in 1975 contain values imputed from the assumptions made above. The total feed grain requirement would decrease a quarter from 1975 to 1983, though a 2.4-million tonne total requirement accounts for no more than 7 percent of Canadian feed grain production. The assumption of a fixed amount of 1,000 litres of milk production from forage, however, is a strong one, and might not hold in a province such as British Columbia, where high quality, high yielding forage may support maintenance and up to 1,700 litres of milk production. This would reduce British Columbia's 1975 dairy feed grain requirements from an assumed 150,000 to 122,000 tonnes.

Provincial feed grain requirements need not necessarily be grown in the home province, and if a province wished to grow all its requirement for dairy production, the dairy feed grain area would account for only a minor percentage of feed grain production. One exception is Quebec, where dairy feed grain requirement accounts for approximately 80 percent of current feed grain production.

While the national feed grain requirement is expected to remain fairly stable, the decreased herd size will lead to proportionate reductions in pasture and forage requirements. The assumed areas are listed in Table 4 and

TABLE 4. PROVINCIAL FORAGE AND PASTURE IMPACT OF A HERD REDUCTION FROM 5.0 TO 3.2 MILLION COWS AND REPLACEMENTS (1975 TO 1983)

Area	Forage Yield Index	Dairy Pasture		Dairy Forage	
		1975	1983	1975	1983
	(Canada 1973-76=100)	(000 ha)		(000 ha)	
Newfoundland	—	—	—	—	—
Prince Edward Island	95	24	14	34	22
Nova Scotia	100	34	20	50	32
New Brunswick	96	27	16	39	25
Quebec	98	800	470	1,200	750
Ontario	124	430	250	630	400
Manitoba	96	87	51	130	82
Saskatchewan	81	88	52	130	84
Alberta	89	160	93	230	150
British Columbia	132	56	33	85	53
Canada	100	1,700	1,000	2,500	1,600

reflect a uniform decrease of 27 percent (rounded to two significant figures) from 1975 to 1983.

Provincial crop areas in Table 4 were calculated by multiplying the number of cows by area per cow. The area per cow was taken as the national average of 0.4 hectares of pasture and 0.8 hectares of forage, weighted by a forage yield index for each province. The index used here is the 1973-76 average of provincial tame hay yields, expressed as a percentage of the Canadian 1973-76 yield. No increase in forage productivity (from 1975 to 1983) has been taken into account.

One further impact of a reduction in the national dairy herd will be a reduction in beef supplied as a by-product of dairying. About one-quarter of the beef consumed in Canada comes from the dairy herd, and this would fall to 15 percent if beef consumption were assumed to remain roughly constant at 1975 levels.

SUMMARY

This article has reviewed some technology-based programs which would cause substantial adjustments in the dairy industry across Canada. As an illustration of the possible extent of technological change, the impacts of these adjustments were expressed as the amounts of land and manpower which would become available for alternative production over and above 1975 levels. The figures calculated serve as illustrations, and do not represent the results of a detailed resource planning exercise.

Some technological barriers to increasing productivity have been identified, but the article did not deal with the large problems of farm adjustment which would be caused by a reduction in the national herd.

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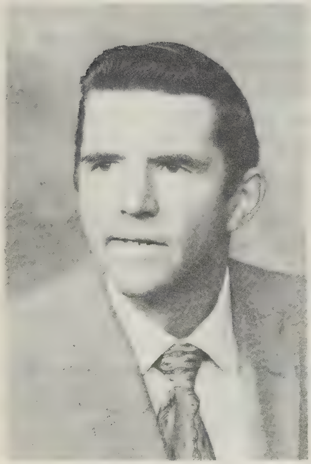
ECONOMIC ANALYSIS OF CROP ROTATIONS IN WESTERN CANADA



L.M. Johnson*

Three-year rotations that included only cereal grains were more profitable than two-year rotations in selected areas of the Prairie Provinces.

Rotations that included an oilseed crop yielded much higher net returns than those with cereal grains alone.

The relative rather than the absolute prices of the various cereal grains and oilseeds should be considered in planning crop rotations.

INTRODUCTION

The technology of cereal grain and oilseed production in Western Canada is undergoing a rapid change. Farm operators are increasing their use of cash cost inputs such as fertilizers, herbicides, insecticides, and insurance. They are also making changes in their tillage practices, as well as in the size and type of equipment used when their farms become larger and technical improvements become available.

These modifications promote efficiency, but rising production expenditures point to the need for farm operators to get the greatest use of all inputs to maximize their returns. This paper outlines component expenditures, yields, and prices and compares income from several rotations of small grain and oilseed crops on "typical" Western Canadian farms. Comparisons of income and expenses per acre is then made between areas and types of farm.

Emphasis is on the relative rather than absolute returns to land, labor, and management among the different regions and types of farm. The information given represents typical farming practices for the principal grain and oilseed crops produced in each area.

The information presented in these budgets should provide a useful comparison for farmers looking at their own expenses and income. The data might also assist policy-makers involved in such programs as crop insurance, land banks, farm credit, and agri-business. For example, crop insurance people want to know crop expenditures when establishing minimum insurance coverage and premiums to make the program effective; land banks and people involved in farm land expropriation procedures want to know cost and income figures to assist them in establishing fair appraisal values on land purchases and in determining rental charges; lenders might benefit from the information in their credit appraisal function to farmers; and agri-business might use the data in determining credit terms on input sales and purchase of outputs.

DESCRIPTION OF AREAS

In six producing areas of Western Canada budgets were developed for crops planted on both summerfallow and stubble. These areas were chosen in the belief that costs and returns varied among areas because of differences in soil, productivity, and weather.[1]

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[1] *Soil Capability for Agriculture,* Fisheries and Environment Canada, Ottawa, Ontario; various folders and maps.

The Peace River area lies in northwestern Alberta and northeastern British Columbia in the Grey Wooded Soil Zone. This area consists of highlands, incised river courses, gently rolling areas, and flatlands. Elevation and the short frost-free period limit crop production in many parts of this area. Annual precipitation ranges from 33 to 56 centimeters; about two-thirds fall in the growing season.

The Melfort-Vegreville area is in northeast-central Alberta and north-central Saskatchewan in the Black Soil Zone. It consists of gently sloping, roughly undulating, and strongly rolling terrain. Topography and climate are limiting factors in crop production. Annual precipitation is from 36 to 46 centimeters, about two-thirds coming in a growing season of about 160 days. Frost is an occasional crop hazard.

The Wilkie-Unity area lies in west-central Saskatchewan in the Dark Brown Soil Zone. It is characterized by level-to-undulating and rolling topography. There are no significant limitations to crop production. Annual precipitation is from 30 to 36 centimeters, with 20 to 25 centimeters coming in a growing season of more than 160 days.

The Swift Current area is located in the Brown Soil Zone of southwestern Saskatchewan. Topography is undulating with some gently-to-moderately rolling phases. The light-textured soils in this area are often susceptible to drought because of their low water-holding capacity. Annual precipitation is 30 to 36 centimeters, with about two-thirds falling in a growing season of over 170 days.

The Estevan-Melita area is in the Dark Brown Soil Zone of southeastern Saskatchewan and the Black Soil Zone of southwestern Manitoba. The terrain is gently undulating to nearly level. Annual precipitation is approximately 43 centimeters, with three-quarters falling during a growing season of more than 160 days.

The Red River Valley lies in the Black Soil Zone of southeast-central Manitoba. The topography is nearly flat. Impeded internal drainage puts some limitation on crop production in parts of this area. Annual precipitation ranges from 48 to 56 centimeters, approximately three-quarters falling as rain during a growing season of over 170 days.

OBJECTIVES AND PROCEDURES

The main objective of this paper was to develop crop expense and income data for each of the above producing areas. Information is presented for the principal crops grown in each area. They include wheat, oats, barley, flaxseed, and rapeseed.

Farm budgeting was used to organize the information, making it possible to explicitly state the relationship of production, price, and expense data to farm income. A budget differs from farm records since the latter present actual historical summaries for an individual farm while the former is a hypothetical example which can be used to estimate the impact of expenses, yields, and prices on income.

Data were collected from sources that included producers, the major machinery dealers, fertilizer and chemical distributors, seed houses, and federal and provincial government agencies. Tillage practices and machinery complements were obtained from previous unpublished studies for which farmers had cooperated, as well as from agricultural-extension and other people knowledgeable of the area. Cost components are those for producing grain and oilseed crops in 1977.

FARM SIZE

It is known that size of operation can affect average production costs in agriculture. In particular, fixed machinery costs decrease as farm size increases.[2] All the cost calculations should be applicable to average-sized farms in each area. For the budget farms the total acreages are as follows: Peace River – 720, Melfort-Vegreville – 720, Unity-Wilkie – 1,040, Swift Current – 1,280, Estevan-Melita – 800, and Red River Valley – 480. These sizes approximate average acreages of farms reported by the 1976 Census of Agriculture. Farms much larger or smaller would likely have somewhat lower or higher per unit expenses than those shown in this paper. Farms of the same size could also show variability in per unit expenses.

Type and Size of Machinery

The machinery complement developed reflects a blend of the typical tillage practices of each area.[3] Types and sizes of machine used in these budgets are listed in Table 1 and are assumed to be capable of performing the tillage, planting, and harvesting operations for the farm sizes mentioned above.

[2] L.M. Johnson, "Economic Analysis of Grain and Oilseed Production in Western Canada," *Canadian Farm Economics*, 10 (August 1975) 4.

[3] Information on tillage practices and machine time in the field not reported in this paper can be obtained from the author.

TABLE 1. MACHINERY COMPLEMENT AND SIZE BY AREA, WESTERN CANADA, 1977

Kind of Machine	Unit of Measure	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
Tractor (diesel)	hp	120	95	120	120	95	95
Tractor (gas)	hp	70	70	90	90	70	70
Cultivator	ft	18	20	24	28	20	16
Drag Harrow	ft	42	42	48	54	48	42
Harrow Attachment[a]	ft	—	20	24	—	20	—
Rodweeder	ft	—	24	28	32	28	—
Discer[b]	ft	—	16	21	24	18	16
Discer	ft	18	—	—	—	—	—
Drill[c]	ft	16	14	16	20	16	14
Sprayer	ft	43	43	54	60	51	51
Swather[d]	ft	14	14	18	21	18	16
Combine[e]	in	44	38	44	48	44	38
Truck	ton	2	2	3	3	2	2

[a]Harrow attachment for cultivator.

[b]Discer with seeder and fertilizer attachment.

[c]Drill with fertilizer attachment.

[d]Self-propelled swather.

[e]Self-propelled combine, cylinder size in inches.

Sources: Unpublished data, Policy, Planning and Economics Branch, Agriculture Canada, Regina.
Proctor, J., "A Consensus of Costs and Returns, Peace River Region," Marketing Division, Production Economics Branch, Alberta Agriculture.
Economics Branch, Manitoba Agriculture.

Machinery Data

The machinery input information was gathered from various sources.[4] Implement dealers provided machinery price data from which depreciation and investment changes were calculated. The straight line method of depreciation was used and calculated on the assumption of ownership of a complete line of new 1977 equipment. Depreciation rates varied, depending on the lifetime expectancy of each machine. Machinery investment interest was charged at the rate of 9 percent a year on half the replacement cost plus salvage value and closely reflected the opportunity cost of capital investment in machinery.

Seed

Seeding rates were based on the rates common to each area.[5] For wheat, oats, and barley, homegrown seed is used and valued at Canadian Wheat Board (CWB) initial prices plus final payments. Commercially-purchased seed is used for flax and rapeseed. Seed cleaning costs were calculated for wheat, oats, and barley but cleaning expenses for rapeseed and flax are part of the purchased seed costs.

Fertilizers

Commercial fertilizers are applied to all crops in each area.[5] The application rates are consistent with those currently recommended by provincial fertilizer advisory councils. Rates and formulations vary among crops grown as well as by area because of differences in soil productivity, temperature, and rainfall.

Weeds and Insects

Chemical weed and insect control is widely practiced in all areas.[5] The estamine form of 2,4-D is commonly used for annual broadleafed weeds in wheat and barley and avadex BW or carbyne for wild oats. Estamine MCPA is used for oats and flax. The rapeseed crop is sprayed with treflan (trifluralin) which controls annual weeds as well as wild oats. Flea beatles have been a problem in some areas; the chemical furadan (carbofuran) was used to control these pests where outbreaks had occurred.

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[4]Unpublished data, Policy, Planning and Economics Branch, Agriculture Canada, Regina. Proctor, J., *A Consensus of Costs and Returns, Peace River Region*, Marketing Division, Production Economics Branch, Alberta Agriculture; Economics Branch, Manitoba Agriculture.

[5]Seeding and fertilization rates, chemical weed and insect control application rates not shown are available from the author. Some farmers will not use all these inputs on all crops, hence their expense could be a little lower.

Rotations that included oilseed crops yielded much higher net returns than cereal grain rotations.

Crop Insurance

All crops on the budget farms were assumed to be insured with the respective provincial crop insurance agencies.[6] They offer protection for crop loss caused by all natural hazards beyond the farmers' control. The insurance costs presented are averages for the area. They vary considerably among areas for crops grown and also for the same crop depending on whether it is grown on summerfallow or stubble. Cost variations are mainly due to yield differences and the extent of coverage available in each province.

Western Grain Stabilization Plan

Contributions to the Western Grain Stabilization Plan (WGSP) are included as a crop service expense.[6] This plan provides protection against anything generally affecting cash flow – such as price decreases, widespread inability to market grain, extensive crop failures, and cost increases which are not offset by higher grain prices. When the net cash flow in any year is less than the previous five-year average, a payment roughly equal to the difference is made from the stabilization fund. This voluntary program is funded by farmers who pay 2 percent of their grain sale proceeds to the stabilization fund – up to a maximum of \$500, and the federal government which contributes twice the amount paid by the producer.

Labor and Land

Estimated quantities of labor used in crop production are based on hours of machine use per acre and an additional 20 percent for the time spent servicing, adjusting, and repairing machines. The wage rate was assumed to be \$5.00 an hour. Farmers or others might choose a different wage rate for their particular situation and also include additional charges for management. Because of variations, charges for labor and management

[6] Both crop insurance premiums and payments to the WGSP might be considered an investment but they are an expense until payouts occur, at which time they become income. About three quarters of the farmers in the CWB area of Western Canada participated in these programs.

are excluded in calculating the crop rotation expenditures. Also, because of the lack of current data on land values, interest on land investment is excluded in this analysis.

Estimated labor charges are in Table 4. These should only be used for comparison purposes; they could be useful to those farmers or others who might wish to estimate their own labor requirements. The annual per acre labor charges for preparing summerfallow and producing crops were lowest at Swift Current. This low resulted from the use of larger machines and from fewer tillage operations to control weed growth which in turn reduced labor requirements. Generally, labor charges are

TABLE 2. YIELDS AND PRICES IN 1977 AND THE 10-YEAR AVERAGE FOR SMALL GRAIN AND OILSEED CROPS BY AREA, WESTERN CANADA

Area and Crop	Yield in 1977[a] Fallow	Yield in 1977[a] Stubble	1977 Price Per Tonne[b]	10-Year Average Fallow	10-Year Average Stubble	10-Year Average Price per Tonne
	—tonnes per acre—		—dollars—	—tonnes per acre—		—dollars—
Peace River						
Wheat	.661	.479	104.00	.718	.536	85.45
Oats	.984	.746	74.49	.874	.672	57.20
Barley	1.004	.725	88.22	.871	.640	69.12
Flaxseed	.328	.264	274.64	.302	.241	195.67
Rapeseed	.483	.363	260.98	.363	.249	165.35
Melfort-Vegreville						
Wheat	.892	.682	105.76	.811	.558	87.21
Oats	.868	.666	76.25	.901	.659	58.96
Barley	1.084	.857	89.98	.988	.690	70.88
Flaxseed	.503	.430	276.40	.429	.307	197.43
Rapeseed	.618	.433	262.74	.460	.304	167.11
Unity-Wilkie						
Wheat	.767	.494	105.98	.762	.509	87.43
Oats	.803	.552	76.47	.879	.625	59.18
Barley	.972	.661	90.20	.954	.658	71.10
Flaxseed	.435	.258	276.62	.396	.269	197.65
Rapeseed	.452	.260	262.96	.460	.322	167.33
Swift Current						
Wheat	.662	.347	105.98	.561	.362	87.43
Oats	.740	.551	76.47	.628	.460	59.18
Barley	.772	.515	90.20	.708	.488	71.10
Flaxseed	.404	.305	276.62	.312	.218	197.65
Estevan-Melita						
Wheat	.916	.621	107.30	.675	.482	88.75
Oats	.967	.625	77.79	.837	.617	60.50
Barley	1.120	.856	91.52	.893	.627	72.42
Flaxseed	.460	.312	277.94	.330	.251	198.97
Rapeseed	.574	.413	264.28	.422	.302	168.65
Red River						
Wheat	.997	.841	107.96	.781	.640	89.41
Oats	.936	.810	78.45	.873	.742	61.16
Barley	1.164	1.035	92.18	.930	.799	73.08
Flaxseed	.555	.429	278.60	.325	.254	199.63
Rapeseed	.714	.588	264.94	.510	.395	169.31

[a] From the Alberta, Saskatchewan, and Manitoba Departments of Agriculture.

[b] From the Canadian Wheat Board and the Winnipeg Commodity Exchange. Prices shown are minus marketing charges.

lower for fallow crops than for stubble crops and higher for oilseeds than for cereal grains. This result was due to some extra tillage before seeding the stubble land and the necessity of a more carefully prepared seedbed for the oilseed crops which in turn increased labor time.

Yields and Prices

The yields per acre and farm prices for wheat, oats, barley, flaxseed, and rapeseed are in Table 2. As the data incidate, 1977 prices for all grain and oilseed

TABLE 3. VALUE OF PRODUCTION FOR SMALL GRAIN AND OILSEED CROPS BY AREA, WESTERN CANADA

Area and Crop	Value Per Acre[a]					
	1977 Prices and Yields		10-Year Average Yields			
			1977 Prices		10-Year Prices	
	Fallow	Stubble	Fallow	Stubble	Fallow	Stubble
	dollars per acre					
Peace River						
Wheat	68.74	49.82	74.67	58.03	61.35	45.80
Oats	73.30	55.57	65.10	50.06	49.99	38.44
Barley	88.57	63.96	76.84	56.46	60.20	44.24
Flaxseed	90.08	72.50	82.94	66.19	59.09	47.16
Rapeseed	126.05	94.74	94.74	64.98	60.02	41.17
Melfort-Vegreville						
Wheat	94.34	72.13	85.77	59.01	70.73	48.66
Oats	66.18	50.78	68.70	50.25	53.12	38.85
Barley	97.54	77.11	88.90	62.09	70.03	48.91
Flaxseed	139.03	118.85	118.58	84.85	84.70	60.61
Rapeseed	162.37	113.77	120.86	79.87	76.87	50.80
Unity-Wilkie						
Wheat	81.29	52.35	80.76	53.94	66.62	44.50
Oats	61.40	42.21	67.22	47.79	52.02	36.99
Barley	87.67	59.62	86.05	59.35	67.83	46.78
Flaxseed	120.33	71.37	109.54	74.41	78.29	53.17
Rapeseed	118.86	68.37	120.96	84.67	76.97	53.88
Swift Current						
Wheat	70.16	36.78	59.45	38.36	49.05	31.65
Oats	56.59	42.13	48.02	35.18	37.16	27.22
Barley	69.63	46.45	63.86	44.02	50.34	34.70
Flaxseed	111.75	84.37	86.31	60.30	61.67	43.09
Estevan-Melita						
Wheat	98.29	66.63	72.43	51.72	59.91	42.78
Oats	75.22	48.62	65.11	48.00	50.64	37.33
Barley	102.50	78.34	81.73	57.38	64.67	45.41
Flaxseed	127.85	86.72	91.72	69.76	65.66	49.94
Rapeseed	151.70	109.15	111.53	79.81	71.17	50.93
Red River						
Wheat	107.64	90.79	84.32	69.09	69.83	57.22
Oats	73.43	63.54	68.49	58.21	53.39	45.38
Barley	107.30	95.41	85.73	73.65	67.96	58.39
Flaxseed	154.62	119.52	90.54	70.76	64.88	50.71
Rapeseed	189.17	155.78	135.12	104.65	86.35	66.88

[a]Equals yield per acre times price per tonne from Table 2.

crops were higher than the previous 10-year average. The same is true for yields of most crops grown on either fallow or stubble.

Value of Production

Table 3 lists the values of production using 1977 prices and yields and the 10-year average yields with 1977 prices and 10-year mean prices.

In many instances barley produced on either summerfallow or stubble had higher total returns per acre than wheat or oats. Although wheat prices were considerably higher than those for barley, higher barley yields more than offset its lower price. This was true in 1977 as well as in the previous 10-year period. Value of production for oilseeds in most cases was significantly higher than for cereal grains in both periods for all areas because of higher prices. Flaxseed prices were higher than those for rapeseed but the latter usually had better returns as a result of higher yields.

Analysis

Based on the preceding assumptions, crop service and machinery expenses for producing crops on both summerfallow and stubble as well as the outlay for preparing summerfallow were determined.

Summerfallow Expenses

Summerfallowing is a practice common on prairie farms where part of the land is left idle each year. Several tillage operations are performed on this land during the growing season to control weeds, and the practice conserves moisture for succeeding crops. Since no crop is produced during the fallow year the cost of this operation must be borne by the crops which follow.

Machinery expenses for preparing summerfallow are given by area in Table 5. Expenditures for this operation range from $3.97 at Swift Current to $7.92 in the Unity-Wilkie area. The low at Swift Current resulted from the use of larger machines and from fewer tillage operations for weed control, and this concomitantly reduced wind erosion on the lighter soils prevalent in this area.

In all areas machinery depreciation and interest on investment accounted for approximately 55 percent of the costs for the fallow operation; the remaining 45 percent was for machine repairs, fuel, and lubricants.

TABLE 4. ANNUAL LABOR CHARGES BY CROP AND AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars per acre			
Summer-fallow	3.27	4.16	3.23	1.72	3.65	3.20
Crops on Fallow						
Wheat	6.13	5.88	4.77	3.50	4.66	5.60
Oats	5.97	5.78	4.69	3.43	4.58	5.52
Barley	6.13	5.88	4.77	3.50	4.66	5.60
Flax	5.99	6.19	5.06	3.79	4.85	6.41
Rapeseed	5.99	6.35	5.24	–	5.05	6.55
Crops on Stubble						
Wheat	5.76	6.21	5.02	3.71	5.17	7.05
Oats	5.60	5.69	4.88	3.64	5.09	7.00
Barley	5.76	6.21	4.96	3.71	5.17	7.05
Flax	6.24	6.96	5.36	4.08	5.50	7.88
Rapeseed	6.24	7.12	5.54	–	5.69	8.05

Source: Calculated from machine time requirements per acre and farm operator wage rate of $5.00 per hour.

Fallow and Stubble Wheat Expenses

Table 6 shows that the combined crop service and machinery expenses for wheat on fallow ranged from $25.49 at Swift Current to $36.70 in the Peace River area. It also shows that the same stubble wheat costs ranged from $26.08 to $39.13 an acre. The higher costs in the Peace River country can be attributed to more crop service inputs and machine expenditures resulting from extra tillage operations and smaller machines. Stubble-cropped wheat costs are higher than fallow wheat costs mainly because of increased use of fertilizers

TABLE 5. MACHINERY EXPENSES FOR PREPARING SUMMERFALLOW BY AREA, WESTERN CANADA, 1977

Area	Repairs, Fuel, Oil and Lubricants	Depre-ciation	Interest	Total
		dollars per acre		
Peace River	3.02	2.06	1.76	6.84
Melfort-Vegreville	3.28	2.24	1.93	7.45
Unity-Wilkie	3.35	2.42	2.15	7.92
Swift Current	1.68	1.23	1.06	3.97
Estevan-Melita	3.00	2.02	1.77	6.79
Red River	2.59	1.58	1.38	5.55

Sources: Sources, Table 1; machinery and fuel companies.

TABLE 6. CROP SERVICES AND MACHINERY EXPENSES FOR WHEAT ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars per acre			
Wheat on Fallow						
Crop Services						
Seed	5.98	5.10	5.10	3.92	5.01	6.03
Weed Spray	4.01	2.48	2.48	2.48	2.48	2.79
Fertilizer	6.57	4.84	4.84	4.65	4.65	6.00
Seed Cleaning	.18	.16	.16	.12	.15	.18
Federal-Provincial Crop Insurance	4.00	2.80	3.00	2.60	2.80	2.00
Other Insurance	—	.50	.56	.70	1.12	—
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	21.99	17.13	16.99	15.41	17.46	18.16
Machinery						
Repairs, Fuel, Oil and Lubricants	5.32	4.77	4.58	3.50	3.99	4.08
Depreciation	5.42	5.09	4.67	3.85	4.50	4.17
Interest	3.97	3.61	3.36	2.73	3.21	3.06
Crop Services and Machinery, Total	36.70	30.60	29.50	25.49	29.16	29.47
Wheat on Stubble						
Crop Services						
Seed	5.98	4.70	4.70	3.92	5.01	6.03
Weed Spray	4.01	2.48	2.48	2.48	2.48	2.79
Fertilizer	11.05	12.94	9.36	6.80	7.45	13.04
Seed Cleaning	.18	.14	.14	.13	.15	.18
Federal-Provincial Crop Insurance	2.80	2.00	2.10	1.30	2.00	2.00
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	25.27	23.51	19.63	15.57	18.34	25.20
Machinery						
Repairs, Fuel, Oil and Lubricants	5.05	4.77	4.77	3.67	4.28	5.24
Depreciation	5.11	5.04	4.82	3.99	4.68	4.85
Interest	3.70	3.67	3.49	2.85	3.38	3.66
Crop Services and Machinery, Total	39.13	38.79	32.71	26.08	30.68	38.95

Sources: Sources, Table 1; producers; machinery dealers; fertilizer, chemical and seed companies; and provincial crop insurance corporations.

and additional machinery expenditures. It should be emphasized that the above costs exclude charges for labor, land investment, and management costs.

Fallow and Stubble Oat Expenses

Combined crop and machinery expenses for oats grown on both fallow and stubble are shown by area in Table 7. Expenditures for these items were lowest in the Swift Current area at about $22 an acre for fallow oats and $24 for stubble oats. All of the other areas had higher costs, mainly because of higher seeding and fertilization rates and the increased outlay for machinery inputs.

Fallow and Stubble Barley Expenses

Combined expenses for fallow barley were approximately $25 an acre at Swift Current, $36 in the Peace

River area, and $28 to $29 in the other areas (Table 8). Outlay for stubble grown barley ranged from approximately $26 an acre in the Swift Current area to $38 at Peace River.

Fallow and Stubble Flax Expenses

Table 9 indicates that combined crop and machinery expenses were about $8 an acre more for stubble flax than fallow flax in the Melfort-Vegreville and Red River areas and about $4 higher in the other areas. The difference is due mostly to higher fertilizer costs and some increased outlay for machinery.

Fallow and Stubble Rapeseed Expenses

Combined expenses for rapeseed on fallow were approximately $37 to $38 an acre in the Unity-Wilkie and Red

TABLE 7. CROP SERVICES AND MACHINERY EXPENSES FOR OATS ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars per acre			
Oats on Fallow						
Crop Services						
Seed	4.85	3.86	3.67	2.90	3.41	5.07
Weed Spray	.90	1.08	1.08	1.08	1.08	3.30
Fertilizer	6.57	4.84	2.88	3.72	3.72	6.00
Seed Cleaning	.33	.27	.26	.20	.23	.35
Federal-Provincial Crop Insurance	3.30	2.50	3.00	2.90	2.60	1.50
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	17.20	13.80	11.74	11.74	12.29	17.38
Machinery						
Repairs, Fuel, Oil and Lubricants	5.58	5.09	4.73	3.63	4.35	4.33
Depreciation	5.68	5.40	4.81	3.95	4.86	4.42
Interest	4.16	3.83	3.45	2.81	3.48	3.25
Crop Services and Machinery, Total	32.62	28.12	24.73	22.13	24.98	29.38
Oats on Stubble						
Crop Services						
Seed	4.85	3.86	3.28	2.90	3.41	4.88
Weed Spray	.90	1.08	1.08	1.08	1.08	3.30
Fertilizer	11.05	12.94	8.21	6.80	7.45	11.92
Seed Cleaning	.33	.27	.22	.20	.23	.34
Federal-Provincial Crop Insurance	2.40	1.50	1.80	1.75	2.00	1.50
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	20.78	20.90	15.44	13.67	15.42	23.10
Machinery						
Repairs, Fuel, Oil and Lubricants	5.23	4.70	4.95	3.77	4.54	5.50
Depreciation	5.29	5.03	5.00	4.07	4.94	5.11
Interest	3.83	3.63	3.64	2.90	3.58	3.85
Crop Services and Machinery, Total	35.13	34.26	29.03	24.41	28.48	37.56

Sources: Sources, Table 6.

River areas and a little over $34 in the other areas (Table 10). Stubble rapeseed costs ranged from about $38 an acre at Wilkie-Unity to nearly $47 in the Red River Valley. Stubble rapeseed costs are higher than fallow for the reasons stated for the other crops. Very little, if any, rapeseed is grown at Swift Current; this crop is therefore excluded from this area.

Buildings, Farm Overhead, and Land Taxes

Annual building charges include repairs, depreciation, and interest on investment. As indicated in Table 11 these costs ranged from $1.40 an acre at Swift Current to $1.64 in the Red River Valley. Farm overhead expenditures include those for small hardware, tools,

TABLE 8. CROP SERVICES AND MACHINERY EXPENSES FOR BARLEY ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars per acre			
Barley on Fallow						
Crop Services						
Seed	4.78	4.08	4.08	3.40	4.11	4.68
Weed Spray	4.01	2.48	2.48	2.48	2.48	2.79
Fertilizer	6.57	4.84	4.84	4.65	4.65	6.00
Seed Cleaning	.23	.20	.20	.17	.20	.23
Federal-Provincial Crop Insurance	3.80	2.70	3.00	2.70	3.50	2.50
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	20.64	15.55	15.45	14.34	16.19	17.36
Machinery						
Repairs, Fuel, Oil and Lubricants	5.51	4.99	4.73	3.62	4.29	4.23
Depreciation	5.58	5.28	4.79	3.96	4.76	4.30
Interest	4.09	3.76	3.44	2.82	3.41	3.16
Crop Services and Machinery, Total	35.82	29.58	28.41	24.74	28.65	29.05
Barley on Stubble						
Crop Services						
Seed	4.78	4.08	3.81	3.40	4.11	4.40
Weed Spray	4.01	2.48	2.48	2.48	2.48	2.79
Fertilizer	11.05	12.94	9.68	6.80	7.45	11.92
Seed Cleaning	.23	.20	.18	.17	.20	.21
Federal-Provincial Crop Insurance	2.70	1.90	2.10	1.80	2.50	2.50
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	24.02	22.85	19.10	15.59	17.99	22.98
Machinery						
Repairs, Fuel, Oil and Lubricants	5.18	4.94	4.89	3.77	4.52	5.39
Depreciation	5.22	5.19	4.93	4.08	4.88	4.98
Interest	3.79	3.78	3.60	2.91	3.54	3.76
Crop Services and Machinery, Total	38.21	36.76	32.52	26.35	30.93	37.11

Sources: Sources, Table 6.

and also the farm share of electricity, telephone, and family car.

Land taxes ranged from $0.70 an acre in the Peace River area to $3.00 in the Red River Valley, the difference being mainly due to land assessment values and services provided within the area.

Crop Rotation Expenditures and Values

Data in Table 12 show crop rotation expenditures and the annual net values by area. Expenses and income for crop rotations in 1977 have been calculated from the preceding tables. Also listed are the average receipts and annual net values using 10-year (1968-1977) average yields with 1977 prices, as well as the average price

TABLE 9. CROP SERVICES AND MACHINERY EXPENSES FOR FLAX ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars per acre			
Flax on Fallow						
Crop Services						
Seed	9.45	9.45	9.45	8.10	8.10	10.80
Weed Spray	1.08	4.01	2.84	2.84	2.84	3.93
Fertilizer	3.72	3.26	3.91	2.79	2.79	3.05
Federal-Provincial Crop Insurance	2.70	2.30	2.60	2.40	3.60	2.60
Other Insurance	—	.50	.56	.70	1.12	—
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	18.20	20.77	20.21	17.77	19.70	21.54
Machinery						
Repairs, Fuel, Oil and Lubricants	5.11	4.69	4.80	3.81	3.99	4.66
Depreciation	5.22	4.98	4.91	4.16	4.48	4.51
Interest	3.83	3.56	3.54	2.93	3.19	3.28
Crop Services and Machinery, Total	32.36	34.00	33.46	28.67	31.36	33.99
Flax on Stubble						
Crop Services						
Seed	9.45	8.64	8.64	8.10	8.10	10.80
Weed Spray	1.08	4.01	2.84	2.84	2.84	3.93
Fertilizer	8.52	12.17	9.68	6.80	8.57	8.15
Federal-Provincial Crop Insurance	2.10	1.40	1.60	2.00	2.20	2.60
Western Grain Stabilization Plan	1.25	1.25	.85	.94	1.25	1.16
Sub-total	22.40	27.47	23.61	20.68	22.96	26.64
Machinery						
Repairs, Fuel, Oil and Lubricants	5.30	5.33	5.15	4.10	4.51	5.83
Depreciation	5.27	5.40	5.12	4.40	4.86	5.23
Interest	3.85	3.91	3.73	3.14	3.52	3.93
Crop Services and Machinery, Total	36.82	42.11	37.61	32.32	35.85	41.63

Sources: Sources, Table 6.

during this period. Average annual net values for these years are the average receipts minus the 1977 rotation expenses. Relative annual net values of rotations can then be compared for these three situations. In each case the 1977 crop rotation expenditures are used with a different set of the following yields and prices:

1. 1977 yields and prices,
2. 10-year average yields and 1977 prices, and
3. 10-year average yields with 10-year prices.

These comparisons are only meant to show the relative extent or sensitivity in net rotation values with different yields and prices.

The following method was used to calculate rotation expenses in 1977. For each area it was assumed that a farm operator had a two-year rotation of fallow-wheat. Taking Peace River as an example, Table 5 shows the expenditures for summerfallow at $6.84 an acre. Data in Table 6 indicate that the combined crop service and

TABLE 10. CROP SERVICES AND MACHINERY EXPENSES FOR RAPESEED ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1977

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Estevan-Melita	Red River
			dollars per acre		
Rapeseed on Fallow					
Crop Services					
Seed	1.60	2.03	1.74	1.74	2.03
Weed Spray	7.38	10.88	10.88	10.88	10.88
Fertilizer	5.64	3.26	6.63	2.79	7.50
Federal-Provincial Crop Insurance	4.00	2.80	3.00	4.40	3.60
Other Insurance	–	.50	.56	1.12	–
Western Grain Stabilization Plan	1.25	1.25	.85	1.25	1.16
Sub-total	19.87	20.72	23.66	22.18	25.17
Machinery					
Repairs, Fuel, Oil and Lubricants	5.17	4.92	5.02	4.21	4.90
Depreciation	5.27	5.12	5.02	4.62	4.67
Interest	3.86	3.66	3.63	3.30	3.41
Crop Services and Machinery, Total	34.17	34.42	37.33	34.31	38.15
Rapeseed on Stubble					
Crop Services					
Seed	1.60	1.74	1.45	1.74	2.03
Weed Spray	7.38	10.88	10.88	10.88	10.88
Fertilizer	11.40	12.17	8.52	8.57	13.77
Federal-Provincial Crop Insurance	3.00	1.70	1.80	2.60	3.60
Western Grain Stabilization Plan	1.25	1.25	.85	1.25	1.16
Sub-total	24.63	27.74	23.50	25.04	31.44
Machinery					
Repairs, Fuel, Oil and Lubricants	5.33	5.51	5.36	4.69	6.06
Depreciation	5.29	5.52	5.22	4.98	5.38
Interest	3.87	4.00	3.82	3.60	4.04
Crop Services and Machinery, Total	39.12	42.77	37.90	38.31	46.92

Sources: Sources, Table 6.

TABLE 11. ANNUAL BUILDING CHARGES, OVERHEAD AND LAND TAXES BY AREA, WESTERN CANADA, 1977

Area	Buildings			Over- head	Land Taxes	Total
	Repairs	Depreciation	Interest			
	dollars per cultivated acre					
Peace River	.50	.53	.47	2.50	.70	4.70
Melfort-Vegreville	.50	.53	.47	3.60	2.00	7.10
Unity-Wilkie	.51	.55	.50	2.65	1.50	5.71
Swift Current	.35	.55	.50	2.80	1.60	5.80
Estevan-Melita	.50	.55	.50	3.05	1.60	6.20
Red River	.50	.60	.54	3.00	3.00	7.64

Sources: Sources, Table 1.

machinery costs of producing the fallow wheat crop were \$36.70 an acre. Since this is a two-year rotation, two years of building charges, farm overhead, and land taxes amounted to \$9.40 an acre (Table 11). The total expense, therefore, for this fallow-wheat rotation was \$52.94 an acre or an average annual outlay of \$26.47 an acre.

Table 3 data for the Peace River area show that the 1977 fallow wheat crop receipts were \$68.74 or \$34.37 an acre per year for this two-year rotation. The average annual net value was therefore \$7.90 (\$34.37 – \$26.47) an acre. This is the return to land investment, labor, and management since these items have been excluded from the rotation expenditures. Using this procedure, the per acre returns for each crop rotation can be calculated and comparisons made both within and between areas.

The lowest annual net rotation values resulted when using 10-year average yields and prices; the next best returns were obtained with 10-year average yields and 1977 prices; and the highest values occurred with 1977 prices and yields. This is true for most rotations in all areas, mainly because of higher prices in 1977 and slightly higher yields for most crops in many areas. For example, the 1977 per tonne price for wheat was 1.2 times greater than the previous 10-year average. The price for oats was 1.3 times greater, barley 1.3, flaxseed 1.4, and rapeseed 1.6.

For cereal grains the 1977 relative annual net values of the various rotations, in most cases, approximated the values obtained when using 10-year yields with 1977 prices. For instance, in the Unity-Wilkie area the 1977 annual net values of a fallow-wheat rotation, a fallow-wheat-barley, and a fallow-wheat-oat rotation were \$16.22, \$17.95, and \$13.31 an acre. With 10-year yields and 1977 prices the rotation values were \$15.96, \$17.68, and \$14.99 an acre. In both cases the value of the fallow-wheat-barley rotation was higher than the others, followed by fallow-wheat and the fallow-wheat-oat combination. This relation was fairly consistent for these rotations in all areas. A similar pattern emerges with the oilseed crops, the highest returns being obtained from a two-year fallow-rapeseed rotation, followed by fallow-rapeseed-barley, and the fallow-flax-wheat rotation.

Using 10-year average prices and yields, the above situation holds only in the Estevan-Melita and Red River areas. In the other areas for cereal grains a two-year fallow-wheat rotation yielded the best returns, replacing the three-year rotation of fallow-wheat-barley in the previous case. This was due to the relatively higher average wheat prices compared with barley for the 10-year period. For this period wheat prices were 1.5 times the price of barley, compared with 1.4 in 1977.

Rotations that included oilseed crops yielded higher returns than cereal grain rotations. For example, for the Melfort-Vegreville area in 1977 the annual net value for a two-year fallow-rapeseed rotation was \$53.14 an acre compared with \$21.05 for fallow-wheat. A three-year rotation of fallow-rapeseed-barley had returns of \$46.52 an acre compared with \$25.11 for fallow-wheat-barley.

Hence it seems important to include oilseed crops in the rotation plans and consider the relative rather than the absolute prices of the various grains.

When computing individual crop values in a rotation, adjustments to yield and price levels can be made from those used in this analysis. Different rotations might also be used to fit a particular farm situation and a new net value computed to compare the relative returns.

Although oilseed rotations yield higher annual net values, oilseed crops, particularly rapeseed, should not

TABLE 12. CROP ROTATION EXPENDITURES AND VALUE OF CROP PRODUCTION BY AREA, WESTERN CANADA, IN 1977 AND 1968 TO 1977

Area and Crop Rotation[a]	Rotation Expense	Rotation Receipts			Annual Net Value[b]		
			10-Year Yields			10-Year Yields	
		1977	1977 Prices	10-Year Prices	1977	1977 Prices	10-Year Prices
		dollars per acre					
Peace River							
Fallow – W	26.47	34.37	37.34	30.68	7.90	10.87	4.21
Fallow – W-B	31.95	44.23	43.71	35.20	12.28	11.76	3.25
Fallow – W-O	30.92	41.40	41.58	33.26	10.48	10.66	2.34
Fallow – F-W	30.81	46.63	46.99	34.96	15.82	16.18	4.15
Fallow – R	25.07	63.02	47.37	30.01	37.95	22.30	4.94
Fallow – R-B	31.11	63.34	50.37	34.75	32.23	19.26	3.64
Melfort-Vegreville							
Fallow – W	26.12	47.17	42.88	35.36	21.05	16.76	9.24
Fallow – W-B	32.04	57.15	49.29	39.88	25.11	17.25	7.84
Fallow – W-O	31.20	48.37	45.34	36.53	17.17	14.14	5.33
Fallow – F-W	33.85	70.39	59.20	44.45	36.54	25.35	10.60
Fallow – R	28.04	81.18	60.43	38.44	53.14	32.39	10.40
Fallow – R-B	33.31	79.83	60.98	41.93	46.52	27.67	8.62
Unity-Wilkie							
Fallow – W	24.42	40.64	40.38	33.31	16.22	15.96	8.89
Fallow – W-B	29.02	46.97	46.70	37.80	17.95	17.68	8.78
Fallow – W-O	27.86	41.17	42.85	34.54	13.31	14.99	6.68
Fallow – F-W	30.41	57.56	54.49	40.93	27.15	24.08	10.52
Fallow – R	28.34	59.43	60.48	38.48	31.09	32.14	10.14
Fallow – R-B	31.63	59.49	60.10	41.25	27.86	28.47	9.62
Swift Current							
Fallow – W	20.53	35.08	29.72	24.52	14.55	9.19	3.99
Fallow – W-B	24.40	38.87	34.49	27.92	14.47	10.09	3.52
Fallow – W-O	23.76	37.43	31.54	25.42	13.67	7.78	1.66
Fallow – F	22.12	55.88	43.16	30.84	33.76	21.04	8.72
Fallow – F-B	25.46	52.73	43.44	32.12	27.27	17.98	6.66
Estevan-Melita							
Fallow – W	24.18	49.14	36.22	29.96	24.96	12.04	5.78
Fallow – W-B	28.83	58.88	43.27	35.11	30.05	14.44	6.28
Fallow – W-O	27.68	48.97	40.14	32.41	21.29	12.46	4.73
Fallow – F-W	29.14	64.49	47.81	36.15	35.35	18.67	7.01
Fallow – R	26.75	75.85	55.76	35.58	49.10	29.01	8.83
Fallow – R-B	30.21	76.68	56.30	38.86	46.47	26.09	8.65
Red River							
Fallow – W	25.15	53.82	42.16	34.91	28.67	17.01	9.76
Fallow – W-B	31.68	67.35	52.66	42.74	35.67	20.98	11.06
Fallow – W-W-B-O	37.37	71.48	57.05	46.16	34.11	19.68	8.76
Fallow – F-W	33.80	81.80	53.21	40.70	48.00	19.41	6.90
Fallow – R	29.49	94.58	67.56	43.18	65.09	38.07	13.69
Fallow – R-W-B-O	39.10	87.78	58.22	49.47	48.68	19.12	10.37

[a]W = wheat, B = barley, O = oats, F = flax, and R = rapeseed.
[b]Annual return to land, labor, and management.

Sources: Calculated from Table 3 and Tables 5 to 11.

be included in a rotation more than once in perhaps four to five years because they are susceptible to many plant diseases and some insect pests. The data suggest that an oilseed crop in some combination with cereal grains would be the best rotation.

Since land investment costs and charges for labor and management have been excluded from the rotation expenses, all of the net annual values presented for the various rotations represent a return to these items.

SUMMARY

Following are some of the salient findings of the economic analysis of the crop rotations.

Although prices for wheat were considerably higher than those for barley in 1977, higher barley yields more than offset its lower price and produced better total returns. Value of production for oilseeds was higher than for cereal grains because of better prices.

The lowest yearly net rotation values resulted when using 10-year average yields and prices with 1977 expenses; the next best returns were obtained with 10-year average yields and 1977 prices; and the highest annual net values occurred with 1977 prices and yields.

For cereal grains the best annual net values came from a three-year fallow-wheat-barley rotation followed by fallow-wheat and fallow-wheat-oats. With oilseeds the highest values were obtained from a two-year rotation of fallow-rapeseed, followed by fallow-rapeseed-barley and fallow-flax-wheat.

Rotations that included oilseed crops yielded much higher net returns than cereal grain rotations. For example, in 1977 for the Melfort-Vegreville area, the annual net value for a fallow-rapeseed rotation was $53.14 an acre compared with $21.05 for fallow-wheat. A three-year rotation of fallow-rapeseed-barley had returns of $46.52 an acre compared with $25.11 for fallow-wheat-barley.

Rotation plans should consider an oilseed crop in some combination with cereal grains, and a study of the relative rather than the absolute prices of the various grains and oilseeds. High oilseed prices in relation to grains (as in 1977) favored oilseed rotations; the opposite would likely be true when grain prices are high.

Yearly rotation values in 1977 ranged from $7.90 an acre for fallow-wheat in the Peace River area to $65.09 for fallow-rapeseed in the Red River Valley.

Machinery expenses for preparing summerfallow ranged from $3.97 an acre at Swift Current to $7.92 in the Unity-Wilkie area.

In 1977 the yearly net value of rotations in the Peace River area ranged from $7.90 an acre for a two-year rotation of fallow-wheat to $37.95 for fallow-rapeseed. This large difference was due mainly to lower-than-average wheat yields and higher-than-average rapeseed yields in 1977, as well as the relatively higher rapeseed prices. Using 10-year average yields and prices, the returns are comparable for these two rotations at $4.21 and $4.94 an acre.

With the Melfort-Vegreville area a two-year rotation of fallow-rapeseed was the most profitable in 1977, yielding an annual net value of $53.14 an acre. The next most profitable was a three-year rotation of fallow-rapeseed-barley at $46.52 an acre. The value for a two-year rotation of fallow-wheat was $21.05, less than half that for the fallow-rapeseed combination. About the same relationship occurred using 10-year average yields with 1977 prices, but returns were comparable with 10-year average prices and yields.

At Unity-Wilkie a fallow-wheat-oat rotation in 1977 was the least profitable at $13.31 an acre compared with $31.09 for fallow-rapeseed. Although expenses were nearly the same for these two rotations at $28 an acre, the much higher annual value for the rapeseed crop more than doubled the returns.

At Swift Current the highest annual value resulted from a fallow-flax combination at $33.76 an acre in 1977, followed by fallow-flax-barley at $27.86. All cereal grain rotations were much less profitable at about $14 an acre. The same was also true for the previous 10-year period.

The 1977 yearly net value of rotations in the Estevan-Melita area ranged from $21.29 an acre for a fallow-wheat-oat rotation to $49.10 for fallow-rapeseed. As in the other areas, oilseeds grown alone or in combination with cereals produced better annual returns than those that included only cereal grains.

For cereal grains a three-year rotation of fallow-wheat-barley was the most profitable in 1977 at $35.67 an acre in the Red River Valley. A five-year combination of fallow-wheat-wheat-barley-oats produced the next best returns at $34.11 an acre, followed by the fallow-wheat rotation at $28.67 an acre. A three-year fallow-flax-wheat and five-year fallow-rapeseed-wheat-barley-oats yielded

nearly equal annual returns of approximately $48 an acre. The most profitable was a fallow-rapeseed combination at $65.09 an acre.

For cereal grains a three-year fallow-wheat-barley rotation generally yielded the best returns in all areas in 1977. For oilseed crops a two-year fallow-rapeseed combination was better than three-year rotations of oilseeds with cereal grains. In all areas rotations that included oilseeds were more profitable than a cereal grain combination. The average annual expenditures were always higher for three-year or longer rotations mainly because of extra crop service expenses for producing the additional crops.

PART-TIME FARMING IN NOVA SCOTIA

T.C. Gunn*

Many Nova Scotians have found part-time farming to be an alternative lifestyle to urban living. Some view part-time farming as a stepping stone to full-time farming. The choice of part-time farming could represent a more meaningful future to the families concerned if the farming operation could be upgraded to improve economic returns. This could also be beneficial to the rural communities and the agricultural industry as a whole.

INTRODUCTION

Part-time farmers comprise a significant portion of Nova Scotian agriculture. Thirty-nine percent of all farmers on census farms[1] in 1976 reported off-farm work and 25 percent reported 127 days or more work off the farm. Seventy-eight percent of part-time farmers were under 55 years of age and 36 percent owned farms in the 70- to 400-acre range. Part-time farmers controlled 59 percent of all the improved acreage of those reporting off-farm work and 18 percent of all improved land. They controlled 18 percent of the total capital value of all farms and approximately 62 percent of the capital of all farms reporting off-farm work.

Agriculture Canada initiated a study on part-time farming in 1976, signifying the importance of part-time farmers to the agricultural industry and the rural scene. The main objective was to secure information relating the importance of part-time farming to the rest of the agricultural sector, and to obtain information about the part-time operators and their farms on an individual basis.

The specific objectives were as follows:

1. to determine the importance of part-time farming in relation to the rest of the agricultural economy;
2. to identify the basic structure of part-time farms in relation to land, labor, capital, and management;
3. to determine the reasons for engaging in part-time farming and the background characteristics of part-time farm families;
4. to obtain information relative to off-farm work by the family and its implications for the farming operation;
5. to determine the future plans of part-time farmers in general and how they specifically relate to the farming operation;

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[1] "Census farm" is defined as a farm, ranch, or other agricultural holding of one acre or more with sales of agricultural products during the 12-month period prior to the census of $1,200 or more.

6. to determine the problems associated with part-time farming and the ways in which people are attempting to solve them; and

7. to determine the sources of technical farming information and advice for part-time farmers.

Definition

Part-time farming almost defies definition. Essentially the definition exists in the minds of researchers and policy makers depending on what they are trying to find out or change. For the purposes of this study, part-time farmers refers to those farmers whose off-farm income was the major income source and the number of days worked off the farm was 127 or more each year. Excluded from the study were those persons who hired all their management and the major portion of their labor.

The number of days of off-farm work criterion was applied in over 80 percent of the cases. Some interviews, however, were done with persons who had chosen farming following retirement from the regular labor force.

METHOD

Secondary data from Statistics Canada were used in determining the importance of part-time farming in relation to the rest of the agricultural sector.

Primary data from on-farm interviews with 261 part-time farmers were used to obtain information on the structure of part-time farms, the background and objectives of part-time farmers, and the problems associated with the entry into and operation of part-time farms.

There was no master list of part-time farmers available from which a random sample could be drawn. With this limitation names were obtained from several sources, including agricultural representatives, extension specialists, and part-time farmers.

Part-time farmers included in the study were from Digby, Annapolis, Kings, Hants, Lunenburg, Halifax, Colchester, Cumberland, Pictou, and Antigonish counties. On-farm interviews were carried out with 280 part-time farmers. Nineteen of these were eliminated from the study because of their failure to meet the set criteria.

SITUATION

Since 1951 the number of agricultural holdings in Nova Scotia has decreased, and the percentage of operators reporting off-farm work has declined 9.1 percent (Table 1).

The number of farmers who mainly work full-time off the farm as a percentage of total farmers, however, has increased. These statistics indicate that fewer farmers, as a percentage of the total, are reporting off-farm work but those who are reporting off-farm work are working off the farm for longer periods.

According to the 1976 census, 66 percent of the farm operators reporting off-farm work worked virtually full-time off the farm (based on 127 days and over of off-farm work). In fact 58 percent reported 157 days or more of off-farm work (Table 2).

In terms of all census farm operators, 25 percent worked full time off the farm.

TABLE 1. OPERATORS OF AGRICULTURAL HOLDINGS REPORTING OFF-FARM WORK, NOVA SCOTIA, 1951-1976

Year	Census Farm Operators	Operators Reporting Off-Farm Work		Operators Reporting 127 Days or More		Operators Reporting 229 Days or More	
	– No. –	– No. –	– % –	– No. –	– % –	– No. –	– % –
1951	23,515	12,694	53.8	5,981	25.4	3,005	12.8
1961	12,518	6,593	52.7	3,815	30.5	1,918	15.3
1966	9,621	4,942	51.3	2,713	28.2	1,505	15.6
1971	6,008	2,741	45.6	1,734	28.9	990	16.5
1976	5,434	2,429	44.7	1,732	31.9	1,015	18.7

Sources: Statistics Canada, *1976 Census of Canada, Agriculture, Nova Scotia,* Catalogue No. 96-803; *1971 Census,* Catalogue No. 96-704.

TABLE 2. DISTRIBUTION OF OPERATORS OF CENSUS FARMS BY NUMBER OF DAYS WORKED OFF-FARM, NOVA SCOTIA, 1976

Days of Off-Farm Work	Respondents Reporting Off-Farm Work		Census Farms
—No.—	—No.—	— % —	— % —
1 – 6	29	2.2	.8
7 – 12	30	2.3	.8
13 – 24	45	3.4	1.3
25 – 48	76	5.7	2.2
49 – 72	83	6.3	2.4
73 – 96	83	6.3	2.4
97 – 126	109	8.2	3.2
127 – 156	96	7.2	2.8
157 – 228	291	21.9	8.5
229 – 365	485	36.5	15.1
Total	1,327	100.0	38.5

Source: Statistics Canada, *1976 Census*, Catalogue No. 96-803.

A larger percentage of part-time farmers than full-time farmers were under 55 years of age (Table 3).

Of those farmers who reported 127 days or more work off the farm, 78.4 percent were under 55 years of age, compared with 54.2 percent for full-time operators of census farms. About 20 percent of part-time farmers were under 35, compared with 11 percent of full-time farmers.

The largest percentage of part-time farmers were in the under-70-improved-acreage range. Thirty-seven percent had between 70 to 400 acres, compared with 53 percent for full-time farmers. This indicates that full-time farmers were generally on larger farms (Table 4).

Part-time farmers reporting off-farm work of 127 days or more controlled 58.9 percent of the improved acreage of all census farms reporting off-farm work and 18 percent of the total improved land of all census farms.

Farm Capital

There is a similarity in the distribution pattern among capital-size classes for part-time farmers and full-time farmers. The largest percentage of part-time farmers were in the $24,950 – $49,949 class. This was also one of the highest percentage classes for the full-time farmers (Table 5). Part-time farmers reporting 127 days or more of off-farm work controlled $66.9 million (18 percent) of capital, compared with $376.8 million for all census farms.

Farm Sales

The value of farm sales is somewhat less for part-time farmers than for full-time farmers. Fifty-four percent of the full-time farmers grossed over $10,000, compared with 17 percent of part-time farmers (Table 6). In 1976 part-time farmers accounted for an estimated 9 percent of the dollar value of agricultural products sold in Nova Scotia.

Summary

In 1976, 25 percent of N.S. census farms were operated by part-time farmers. These farmers controlled approximately 18 percent of the total improved land, 18 percent of the total capital, and an estimated 9 percent of the total value of agricultural products sold in the province. These types of relationships were also evident from the 1971 census. Hence part-time farmers are a significant part of the agricultural economy.

TABLE 3. AGE DISTRIBUTION OF FULL- AND PART-TIME FARM OPERATORS ON CENSUS FARMS, NOVA SCOTIA, 1976

Age Group	Operators Reporting 0 Days of Off-Farm Work		Operators Reporting 25-126 Days of Off-Farm Work		Operators Reporting 127 Days or More of Off-Farm Work	
	– No. –	– % –	– No. –	– % –	– No. –	– % –
Under 25	29	1.4	5	1.4	11	1.3
25 – 34	211	10.0	58	16.5	161	18.5
35 – 44	349	16.5	75	21.4	244	28.0
45 – 54	556	26.3	102	29.1	267	30.6
55 – 59	303	14.3	49	14.0	94	10.8
60 – 64	298	14.1	37	10.5	73	18.4
65 – 69	178	8.4	17	4.8	17	1.9
70 and over	190	9.0	8	2.3	5	0.6
Total	2,114	100.0	351	100.0	872	100.0

Source: Statistics Canada, *1976 Census*, Catalogue No. 96-803.

TABLE 4. DISTRIBUTION OF FULL- AND PART-TIME OPERATORS BY SIZE OF FARM, IMPROVED ACRES, CENSUS FARMS, NOVA SCOTIA, 1976

Size of Farm	Operators Reporting 0 Days of Off-Farm Work		Operators Reporting 25-126 Days of Off-Farm Work		Operators Reporting 127 Days or More of Off-Farm Work		Operators Reporting 229 Days and More of Off-Farm Work	
– ac –	– No. –	– % –	– No. –	– % –	– No. –	– % –	– No. –	– % –
Under 70	925	43.9	186	53.0	546	62.6	304	62.7
70 – 129	527	24.9	86	24.5	198	22.8	109	22.5
130 – 179	242	11.4	31	8.8	63	7.2	34	7.0
180 – 239	173	8.2	22	6.3	29	3.3	18	3.7
240 – 399	172	8.1	19	5.4	25	2.9	14	2.9
400 – 559	40	1.9	6	1.7	10	1.1	5	1.0
560 – 759	17	.8	1	0.3	1	0.1	1	0.2
760 – 1119	7	.3	–	–	–	–	–	–
1120 – 1599	8	.4	–	–	–	–	–	–
1600 plus	3	.1	–	–	–	–	–	–
Total	2,114	100.0	351	100.0	872	100.0	485	100.0

Source: Statistics Canada, *1976 Census,* Catalogue No. 96-803.

CHARACTERISTICS OF PART-TIME FARMERS

Background

The majority of persons engaged in part-time farming were born and raised on farms in Nova Scotia. Two-thirds had farm backgrounds and 78 percent were born in the province. While 75 percent of the spouses were born in Nova Scotia, slightly less than 50 percent had farm backgrounds (Table 7).

Education

The average number of years completed in school was 10 for the farm operators and 11 for their spouses. The largest number of respondents, both operators and spouses, completed either 8 or 12 years of school (Table 8).

Forty-seven percent of the part-time operators had no training beyond grade school. The additional training of those who did was generally in non-agricultural areas.

TABLE 5. DISTRIBUTION OF FULL- AND PART-TIME OPERATORS BY TOTAL CAPITAL VALUE OF ASSETS OPERATED, CENSUS FARMS, NOVA SCOTIA, 1976

Capital Range	Operators Reporting 0 Days		Operators Reporting 25-126 Days		Operators Reporting 127 Days or More	
– $ –	– No. –	– % –	– No. –	– % –	– No. –	– % –
Under 9,950	20	.9	7	2.0	22	2.5
9,950 – 14,949	34	1.6	9	2.6	19	2.2
14,950 – 19,949	48	2.2	13	3.7	36	4.1
19,950 – 24,949	86	4.1	8	2.3	42	4.8
24,950 – 49,949	405	19.2	105	29.9	226	25.9
49,950 – 74,949	357	16.9	72	20.5	219	25.1
74,950 – 99,949	249	11.8	48	13.7	127	14.6
99,950 – 149,949	341	16.1	40	11.4	102	11.7
149,950 – 199,949	199	9.4	28	8.0	40	4.6
199,950 plus	375	17.7	21	5.9	39	4.5
Total	2,114	100.0	351	100.0	872	100.0

Source: Statistics Canada, *1976 Census,* Catalogue No. 96-803.

TABLE 6. DISTRIBUTION OF FULL- AND PART-TIME OPERATORS BY VALUE OF AGRICULTURAL PRODUCTS SOLD, CENSUS FARMS, NOVA SCOTIA, 1976

Value of Products Sold	Operators Reporting 0 Days		Operators Reporting 25-126 Days		Operators Reporting 127 Days or More	
– $ –	– No. –	– % –	– No. –	– % –	– No. –	– % –
1,200 – 2,499	381	18.1	127	36.2	377	43.3
2,500 – 4,999	290	13.8	87	24.8	228	26.2
5,000 – 9,999	287	13.7	59	16.8	122	14.0
10,000 – 14,999	161	7.7	22	06.3	52	06.0
15,000 – 24,999	189	9.0	18	05.1	32	03.7
25,000 – 34,999	147	7.0	12	03.4	10	01.1
35,000 – 49,999	159	7.6	11	03.1	13	01.5
50,000 – 74,999	171	8.1	9	02.6	20	02.3
75,000 – 99,999	95	4.5	1	00.3	4	00.5
100,000 plus	220	10.5	5	01.4	13	01.5
Total	2,100[a]	100.0	351	100.0	871	100.0

Source: Statistics Canada, *1976 Census,* Catalogue No. 96-803.

[a]Fourteen full-time farms and one farm reporting off-farm work were institutional farms that were not classified according to value of products sold.

TABLE 7. BIRTHPLACE OF FARM OPERATORS ENGAGED IN PART-TIME FARMING, NOVA SCOTIA, 1977

Birthplace	Operators Responding		Responding Spouses	
	– No. –	– % –	– No. –	– % –
Nova Scotia	203	77.8	182	74.6
Ontario	12	4.8	7	4.5
United States	10	3.9	11	4.1
Britain	8	3.3	12	4.9
Holland	8	3.3	4	2.9
New Brunswick	6	2.3	10	1.6
Others[a]	14	4.6	18	7.4
Total	261	100.0	244	100.0

[a]Other Canadian Provinces, Cuba, and the U.S.S.R.

TABLE 8. YEARS COMPLETED IN SCHOOL BY 261 PART-TIME OPERATORS AND THEIR SPOUSES, NOVA SCOTIA, 1977

Years in School	Operator	Spouse
	No.	
None	2	0
1 – 7	25	14
8	127	112
9 – 11	35	14
12	69	103
13	3	5

Approximately 40 percent of all respondents had training in non-agricultural areas, compared with 13.4 percent in agricultural areas (Table 9).

Age of Operator

Part-time farm operators were generally quite young. Seventy-eight percent were under 55 years of age and 48 percent were under 45. Eighty-four percent of the spouses were under 55 and, on the average, were three years younger than the farm operators (Table 10).

TABLE 9. TYPE OF FORMAL TRAINING BEYOND GRADE SCHOOL BY 261 PART-TIME FARM OPERATORS, NOVA SCOTIA, 1977

Type of Training	Respondents	
	– No. –	– % –
None	122	46.7
University – Non-Agriculture	30	11.5
University – Agriculture	9	3.4
College – Non-Agriculture	7	2.7
College – Agriculture	13	5.0
Short Courses – Non-Agriculture	3	1.1
Short Courses – Agriculture	7	2.7
Technical Training – Non-Agriculture	42	16.1
Technical Training – Agriculture	6	2.3
Other[a]	22	8.5

[a]Correspondence, Armed Services, High School Upgrade, Business, and Commerce.

TABLE 10. AGES OF 261 PART-TIME OPERATORS AND THEIR SPOUSES, NOVA SCOTIA, 1977

Age	Operator		Spouse	
	– No. –	– % –	– No. –	– % –
Under 25	3	1.1	18	6.9
25 – 34	60	23.0	72	27.6
35 – 44	65	24.9	79	30.3
45 – 54	75	28.7	49	18.8
55 – 59	21	8.0	18	6.9
60 – 64	23	8.8	17	6.5
65 – 69	12	4.6	6	2.3
70 and over	2	.8	2	.8
Total	261	100.0	250	100.0
Average Age	45		42	

The number of children living at home was approximately two per family. Fifty-four percent of all children were over 12 years of age (Table 11).

INFORMATION SOURCES

The main information sources for the study were provincial agriculture personnel and farmers. Information was mainly obtained through discussions with these people (Table 12). The responses listing Departmental personnel as an information source could be biased since they were listed as one of the important sources of names for the study sample.

Farm papers and government publications were the most important media sources of information. Farm meetings and agricultural short courses were not an important source, probably because of the lack of courses specifically designed for part-time farmers and the time conflicts associated with such courses. Some farmers listed more than one main information source.

TRAINING NEEDS

Respondents named the following major areas in which they felt a need for further training: animal husbandry, crop production and soil analysis, and mechanical work and welding. They also expressed concern for keeping abreast with modern technology and programs. A significant number indicated that they did not need further training or skills.

When asked the form of training they would prefer, 52 percent said they would like short courses in their immediate vicinity. Many said that they would also like to have a place available as a self-learning resource center, similar to a library where self-learning packages would be available on particular subjects. These could be studied there or borrowed for in-depth study (Table 13).

As expected, a high percentage of respondents wished to have short courses scheduled during the evening. Very few were interested in courses during the weekends or summer. For courses of a longer duration, an evening a week for a series of weeks met with favorable responses. Many were also interested in classroom instruction combined with farm tours.

REASONS FOR PART-TIME FARMING

More than one reason was ranked first by 261 farm operators when asked why they engaged in part-time farming. "Like the country," "to get started in farming," and "to increase earnings" accounted for 72.4 percent of the respondents or 59.3 percent of total reasons given (Table 14).

When asked for their second choice the respondents still ranked "like the country" first. "A good place to bring up children" came up to second from fifth. "To get started in farming" ranked third. Some respondents

TABLE 11. AGES AND NUMBER OF CHILDREN OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Age	Children								Total Children	
	1st	2nd	3rd	4th	5th	6th	7th	8th		
	No.								– No –	– % –
1 – 5	34	33	22	6	2	0	0	1	98	19.8
6 – 11	37	41	27	14	4	5	0	0	128	25.9
12 and over	126	78	41	13	7	1	2	0	268	54.3
Total	197	152	90	33	13	6	2	1	494	100.0
Average Age	13.7	11.2	10.0	9.8	10.7	9.7	9.0	4.0	11.8	

TABLE 12. INFORMATION SOURCES OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Information Source	Operators Responding First Rank of Importance	Sub-Total of First Rank for Each Division
	No.	
Farm Discussions		
Agricultural Representative	73	
Other Department Personnel	37	
Other Farmers	78	
Other Family Members at Home	3	
		191
Observing		
Experimental or Demonstration Farms	2	
An Agricultural School	6	
Demonstrations at Field Days	1	
Other Farmers	27	
		36
Media		
Radio	7	
Television	4	
Farm Papers	18	
Newspapers	2	
Magazines	8	
Government Publications	19	
		58
Meetings		
Farmer Meetings	5	
Agricultural Short Courses	4	
Fairs and Exhibitions	6	
		15
Experience	15	
		15
Total		315

TABLE 13. SKILLS AND TRAINING REQUIREMENTS SUGGESTED BY 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Training Area or Skill	Respondents	
	—No.—	— % —
Animal Husbandry	51	16.1
Crop Production and Soil Analysis	71	22.5
Mechanical Work and Welding	42	13.3
Keeping Abreast of Modern Technology and Programs	23	7.3
Management	14	4.4
Other[a]	79	25.0
No Training Required	36	11.4
Total	316	100.0
Form of Training Desired		
Self-Learning Packages at a Resource Center	51	18.1
Correspondence Courses	32	11.4
Vocational Courses	14	4.9
Short Courses in Immediate Area	147	52.1
Field and Demonstration Days	2	.7
Not Interested	36	12.8
Total	282	100.0

[a]Grading Beef 1, Grading Chinchillas and Mink 2, Meatcutting 9, Bookkeeping 4, Greenhouse Work 6, Orchardry 4, Chemical Application 5, Machinery Operation 5, Beekeeping 5, Woodlot Management 7, Control of Diseases and Insects 3, Carpentry 7, Weed Control 3, Farrier Training 4, Marketing Skills 5, Strawberry Production 3, Farm Safety 1, and Experience 5.

The desire to live in the country was the main reason respondents gave for taking up part-time farming.

commenting on their reasons felt it was a good life, that they really enjoyed farming, and would prefer it to life in the city.

Since the respondents had been involved in part-time farming for over a year, they were asked if their original reasons for engaging in it were still valid. Eighty-six percent said yes, 11 percent said no, and 2 percent made no comment. Some gave qualified answers. Several believed that as time went on their goals would be realized. Low beef prices were particularly responsible for the economic reason for engaging in part-time farming not being realized. Many were confident, however, that prices would get better; they were optimistic and not willing to change the enterprise or give up part-time farming.

The spouse's contribution is very important in farming operations, and part-time farming in particular, since the spouse must do a lot of the work when the operator is at the off-farm job. Ninety percent of the spouses responding indicated that they liked part-time farming; 10 percent did not (Table 15).

FUTURE PLANS

Most part-time farmers said that they wanted to continue part-time farming or be involved in agriculture full-time (97 percent); 3 percent indicated that they wished to quit farming (Table 16). A few respondents gave first ranking to more than one plan, e.g., part-time farming, and retire and farm.

Fifty respondents (19 percent) indicated that they wished to become involved in farming full-time. This is consistent with the reasons for engaging in part-time farming in the first place.

Based on the future plans and the average age of operators (45), it appears that part-time farmers will be a permanent part of the agricultural sector.

THE FARM OPERATION

Most part-time farmers acquired their farms in recent years – 38.7 percent in the last five and 68.9 percent in the last 15 (Table 17).

TABLE 14. REASONS FOR ENGAGING IN PART-TIME FARMING RANKED ACCORDING TO FIRST CHOICE, 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Reason Stated	Rank of Reason	Number Responding	Percentage of Respondents Stating Reasons	Percentage of Total Reasons Given
Like Country	1	94	36.0	29.5
To Get Started in Farming	2	65	24.9	20.4
Increase Earnings	3	30	11.5	9.4
Inherited Property	4	25	9.6	7.8
Good Place to Bring up Children	5	17	6.5	5.3
Retirement Plans	6	15	5.8	4.7
Moved from Full-Time Farming	7	13	5.0	4.1
Love to Farm	8	11	4.2	3.5
Self-Sufficiency and Own Boss	9	9	3.5	2.8
Other[a]		40	15.3	12.5

[a]Health 7, Housing 6, Relatives 6, Unemployment 4, Bought Farm from Parent or Relative 4, Investment 3, Lower Living Costs 2, Love of Animals 2, Start Business 2, Growing Good Quality Food 1, To Get Son Interested 1, Income Tax Relief 1, and To Raise Purebred Cattle 1.

TABLE 15. SPOUSES' ATTITUDES TO PART-TIME FARMING, 248 RESPONSES, NOVA SCOTIA, 1977

Attitude	Respondents	
	– No. –	– % –
Liked at First and Still Likes	207	83.5
Disliked at First and Still Does	18	7.2
Disliked at First, Now Likes	15	6.1
Liked at First, but Not Now	8	3.2
Total	248	100.0

LAND USE

The average size of farm operated by part-time farmers (including owned and rented land) was 219 acres. Of this, 76 acres were under crops and tame pasture. Based on acres owned, the average tillable acreage was 61. The major portion of land was in woods, the average (including owned and rented) being 122 acres. Of this, the operators owned an average of 117 acres (Table 18).

TABLE 16. FUTURE PLANS OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Plans	Responses	
	– No. –	– % –
Continue Part-Time Farming	172	63.5
Farm Full-Time	51	18.8
Retire and Farm	39	14.4
Quit Farming and Use as Place of Residence	6	2.2
Move to Other Residence	3	1.1
Total	271	100.0

Sixty-one percent of the part-time farmers owned 10 to 69 acres of cropland, excluding tillable pasture. Eleven percent owned no cropland, 16 percent owned over 69 acres, and 12 percent less than 10 (Table 19).

When considering only those who owned land, the average crop-acre size was 43 acres; for tillable pasture it was 31. For those who owned woods the average size was 145 acres. The average size of rented cropland was 49 acres.

TABLE 17. ACQUISITION TIME CATEGORIES OF FARM PROPERTIES OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Time Category	Respondents		Accumulative
– yr –	– No. –	– % –	Percentage
1 – 5	101	38.7	38.7
6 – 10	52	19.9	58.6
11 – 15	27	10.3	68.9
16 – 20	15	5.8	74.7
21 – 25	13	5.0	79.7
26 – 30	23	8.8	88.5
31 – 35	11	4.2	92.7
36 – 40	12	4.6	97.3
41 and over	7	2.7	100.0

Among the part-time farmers interviewed, there was a wide range of crops grown, although any particular farm might not have had a particularly large number. Of those who grew hay (77 percent) the average acreage was 36. The popular cereal crop was oats, grown by 27 percent of the respondents (Table 20).

TABLE 18. AVERAGE ACREAGE OWNED AND RENTED BY 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Description	Owned	Rented	Total	Percentage of Total Operators
	—	acres	—	— % —
Crop Land	38.1	10.7	48.8	22.2
Tillable Pasture	22.5	4.3	26.8	12.2
Rough Pasture	13.2	4.1	17.2	7.9
Woods	117.5	4.3	121.8	55.5
Other	3.6	.1	3.7	1.7
Farmstead	1.1		1.1	.5
Total	196.0	23.5	219.4	100.0

TABLE 19. CROP ACRES OWNED BY 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Acreage Category	Respondents per Category	
	— No. —	— % —
0	28	10.8
1 — 9	31	11.9
10 — 69	159	60.9
70 — 129	39	14.9
130 and over	4	1.5
Total	261	100.0

TABLE 20. AVERAGE ACREAGE OF CROPS GROWN BY PART-TIME FARMERS CATEGORIZED BY CROP, AND NUMBER OF FARMERS GROWING THE CROP DURING THE 1976 CROPPING YEAR, NOVA SCOTIA, 1977

Type of Crop	Average Acreage[a] of Crop Grown on Owned Land	Part-Time Farmers Growing the Crop
	— ac —	— No. —
Oats	10.9	71
Barley	5.0	11
Mixed Grain	14.6	22
Wheat	14.3	3
Buckwheat	14.3	5
Potatoes	1.1	19
Blueberries	33.5	20
Strawberries	1.3	13
Raspberries	3.1	2
Apples	6.4	27
Hay	36.3	200
Haylage	19.5	2
Corn Silage	14.7	11
Dry Corn	27.5	2

[a]Zero responses are not included in the averages; therefore, acreages are not additive.

Silages were grown by a very small percentage of the farmers. This was probably due to the high investment required and the small acreage grown.

TYPE OF LIVESTOCK FARMING

Sixty-four percent of the operators interviewed had beef cows on their farms. Several who had steers also reported having beef cows and vice versa. Considering only those who owned beef cows, the average number was 14. Many part-time farmers had more than one livestock enterprise (Table 21).

TABLE 21. TYPES OF LIVESTOCK ENTERPRISES ON 261 PART-TIME FARMS, NOVA SCOTIA, 1976 PRODUCTION YEAR

Enterprise Type	Respondents	
	— No. —	— % —
Beef Cows	167	14.3
Steers	98	4.7
Dairy Cows	45	4.3
Sows	19	7.3
Market Hogs	21	28.9
Ewes and Rams	30	40.5
Hens	98	287.7
Rabbits	7	18.7
Pleasure Horses	78	2.5
Goats	15	5.6

INVESTMENT

The average investment by part-time farmers was approximately $76,000. Seventy-nine percent was for real estate, 13 percent for machinery, and 8 percent for livestock. Thirty-seven percent ($22,493) of the real estate value of $59,891 was for the farm house. Valuing one quarter of the house for farm use, the average farm real estate value was $42,995 and the total farm investment $59,183 (Table 22).

TABLE 22. AVERAGE INVESTMENT OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Description	Average Investment[a]		Average Farm Investment[a]	
	— $ —	— % —	— $ —	— % —
Real Estate	59,891	78.7	42,995	72.7
Machinery and Equipment	10,045	13.2	10,045	17.0
Livestock	6,143	8.1	6,143	10.3
Total	76,079	100.0	59,183	100.0

[a]Full value of house is included in average investment and one quarter value included in average farm investment.

The average real municipal assessment for part-time farmers was $24,170, 2.5 times less than the value assigned by the respondents. The average value of real estate rented was $1,429, making a total capital value of $77,508 in the control of part-time farmers, or $60,612 of farm capital since none of the farmers rented the farm house.

INCOME, EXPENSES, AND RETURNS

The average income from farm sales was $5,239; 48 percent of this was made up of livestock sales, reflecting the large number of part-time farmers with beef or dairy enterprises. The average value of farm products used in the home (valued at farm prices) was $592; 30 percent was for beef and veal and 27 percent for wood used as fuel in the home. The figure does not include a value for the use of the home. The gross value of farm sales and products used in the home was $5,831. Not including interest on equity and depreciation, the average total expenses per farm was $6,412, resulting in a loss of $581 (Table 23). If depreciation is considered, the loss increases to approximately $2,626.

TABLE 23. AVERAGE INCOME, EXPENSES, AND RETURNS OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1976 PRODUCTION YEAR

Income, Expenses, and Returns	1976	
	– $ –	– % –
Income		
Farm Sales	5,239	89.9
Farm Products Used in Home	592	10.1
Gross Value	5,831	100.0
Cash Expenses		
Feed and Straw	1,044	16.3
Hired Labor	637	9.9
Fertilizer and Sprays	622	9.7
Building Repairs	531	8.3
Gas and Oil	456	7.1
Machinery Repair	355	5.5
Truck Expense	336	5.2
Custom Work	294	4.1
Taxes	259	4.1
Utilities	211	3.3
Seeds and Plants	196	3.1
Fence Repairs	181	2.8
Insurance	173	2.7
Containers and Twine	136	2.1
Vet, Med., and Breeding	89	1.4
Interest	75	1.2
Miscellaneous	305	4.8
Livestock Purchases	512	8.4
Total	6,412	100.0
Net Gain (Loss)	(518)	

The major expense items were feed and straw, hired labor, fertilizers and sprays, building repairs, and livestock purchases. These accounted for over 52 percent of cash expenses.

LIABILITIES

When acquiring the part-time farm, some purchased it outright while others inherited the property, received it as a gift, or some combination of these methods. The average price paid was $14,359. Those who received their properties through inheritance or gift felt that on the average their properties were worth $13,957 at the time of acquisition, close to that of those who bought their farms.

The average amount of money owed at the time of purchase, including those who had no debts, was $8,419. In 1977 the average farm debt was $7,202. The part-time farmers actually reduced their debt $1,217 from the time of purchase over approximately 14 years. Thirty-three percent of the part-time farmers had no farm debt at the time of purchase, compared with 44 percent in 1977. Considering only those in debt, the average amount was $13,159 at the time of purchase and $9,447 in 1977, a reduction of $3,712 over a 14-year span. It appears that part-time farmers are rather low risk takers when borrowing money. The average investment at the time of the study was $76,079, an increase of $65,131 from the time of purchase. The majority of the increase was due to inflation, especially in real estate values. No attempt was made in the study to isolate improvement costs. Based on farm investment (i.e., farm value of house included in investment), assets exceeded liabilities by $51,981. With the total value of the house included, the figure was $68,877.

Some respondents reported more than one credit source at the time of purchase; from 261 responses, 77 (28 percent) indicated none. The major sources of credit in descending order were the Nova Scotia Farm Loan Board, banks, savings, Veterans Land Act, and trust companies; 79 percent of the 194 requiring credit obtained it from these sources. About 7 percent received it from a relative or friend. Very few obtained financing from finance companies, or from the Farm Credit Corporation (most likely because of the requirement that they be farming full-time in five years).

MARKETING

Approximately 59 percent of the respondents reported the marketing of beef cattle and calves. Of these, 77 percent marketed their cattle through auction sales, farm slaughter, retailed farm gate, and combinations of these.

Fourteen percent marketed their cattle directly to other farmers, while the remainder marketed through such methods as slaughter houses and drovers.

Marketing was a problem raised by over 48 percent of the respondents, who cited low prices as the main concern. Lack of marketing alternatives such as livestock killing facilities and high transportation costs on a percentage basis were also problems identified.

Forest products were mainly sold at the roadside. Roadside stands were the main method of selling honey and eggs, and an important method for vegetables and fruit. The retail and wholesale outlets were also important methods of selling vegetables. Twenty-five percent marketed their fruit through processing plants.

Lambs were mainly marketed through farm slaughter, retailing at the farm gate or through auction sales. Auction sales and wholesalers were the most prominent outlets for marketing sheep.

Hogs were marketed in many ways, including farm slaughter and retailing at the farm gate, and sales to other farms.

The majority of farmers generally indicated no marketing problems for all their products. There was a general desire, however, for better prices to keep pace with increased costs.

PRODUCTIVITY OF PART-TIME FARMERS

Land Use

Crop yields and expenditures on fertilizer were used as proxies for measuring land productivity. The enumerators had some difficulty getting yields from part-time farmers, mainly because they did not have accurate data.

Much of the data given, therefore, were based more on educated guesses than on recorded information. Care should be exercised in making any conclusions. With the exception of oats and hay, the per acre yield figures were lower for part-time farmers than the yields published by Statistics Canada (Table 24). For other crops not shown, the data were too unreliable.

The average amount spent on fertilizer, lime, and sprays for all part-time farmers was $622. Thirty-seven of the 261 farmers interviewed purchased no inputs in this category. From under $100 to under $1,000 (in $100 intervals) there was a fairly even distribution of the numbers of part-time farmers buying these inputs. Based on Statistics Canada data, the dollar amount spent on lime and fertilizer per census farm in 1976 was $1,033, $411 greater than that spent by part-time farmers. The average expenditure per tillable acre for part-time farmers was $8.22, compared with $13.46 for all farmers.

Capital Turnover

Capital turnover for part-time farmers was approximately 10.14 years (total assets divided by total cash sales). This is a poor turnover compared with what is considered normal for commercial farms. Of the enterprises engaged in by part-time farmers, the lowest capital turnover rate was for beef. Farm management specialists generally consider a four-to five-year turnover normal for this enterprise. The part-time farmers said that insufficient production for the amount of investment in their farms was one of the major problems of part-time farming.

TABLE 24. COMPARATIVE PER ACRE YIELDS OF SELECTED CROPS FOR NOVA SCOTIA AND 261 PART-TIME FARMERS, NOVA SCOTIA, 1976

Crop	Yield Per Acre, Statistics Canada	Yield Per Acre, Part-Time Farmers
Oats (bu)	53.0	78.0
Barley (bu)	49.0	23.1
Mixed Grain (bu)	56.0	33.6
Hay (ton)	2.1	2.2
Corn Silage (ton)	14.8	6.1
Strawberries (qt)	—	2,248.0

Output-Input Ratio

For every dollar's worth of cash expenses, part-time farmers generated 91 cents worth of sale; or conversely, every dollar's worth of sales generated $1.09 worth of cash expenses. Excluded from cash expenses were depreciation on machinery and buildings. Sales included the value of products consumed in the home but excluded inventory changes. For every dollar received, they had to spend another nine cents from their outside income to meet cash costs. No money was available from farm sources to pay for depreciation, family labor, management, and equity capital. For the province as a whole in 1976, using the same basis, farmers generated $1.49 worth of sales for every dollar's worth of expenses. Farmers had 49 cents of every dollar received to apply towards the above-mentioned factors.

TIME SPENT OFF-FARM AND ON-FARM

Time Spent on Off-Farm Employment

Each farm operator spent an average of 1,597 hours a year on off-farm employment, the equivalent of approximately 200 days based on an eight-hour day. Some operators did not work off the farm because they were retired or had investment income only. Of the 247 who did work off the farm, the average time was 1,687 hours, or approximately 210 days. The operator's spouse spent an average of 348 hours on off-farm work. The average was low because many, 188 (75 percent), did not work off the farm. For those who did, the average time was 1,245 hours, or the equivalent of 155 days.

The farm operators who worked off the farm travelled an average of 17.5 miles one way to their place of employment and it took them 25 minutes. Travel time kept the operator away from the farm approximately 175 hours a year.

Time Spent on On-Farm Employment

The operator spent an average of 1,511 hours a year on farm work, compared with 511 for the spouse and 537 for the children and other members of the household. The total labor input to the farm was 2,559 hours, approximately one man equivalent based on an eight-hour day, six days a week, or approximately .83 man equivalent using 10 hours a day (Table 25).

TABLE 25. AVERAGE NUMBER OF HOURS SPENT ON FARM WORK BY PART-TIME FARMERS AND MEMBERS OF THEIR HOUSEHOLDS, 1976, NOVA SCOTIA

Household Member	Hours Spent	
	– No. –	– % –
Operator	1,511	59.1
Spouse	511	19.1
Children	478	18.7
Other Household Members	59	3.1
Total	2,559	100.0

The spouse, children, and other household members are an important labor source on part-time farms, accounting for 41 percent of the total labor input.

Off-Farm Occupation

Part-time farmers engage in practically all types of non-farm work (Table 26). No particular type of employment was distinctively associated with part-time farming. The majority of part-time farmers were salaried or wage workers and committed to a normal 35- to 40-hour work week. Teachers and school bus drivers could be considered the most suitable for part-time farming, mainly because of the time available during the summer months. Only 12 percent of those interviewed were in this category.

TABLE 26. NON-FARM EMPLOYMENT OF 261 PART-TIME FARMERS, NOVA SCOTIA, 1977

Type of Employment	Respondents	
	– No. –	– % –
Construction and Building Trade	40	15.3
Transportation	22	8.4
Teachers	16	6.1
Government Workers	32	12.2
Farm Workers	14	5.4
Laborers	31	11.9
Industrial Workers, Skilled	21	8.1
Self-Employed	22	8.4
Services	13	5.0
Miscellaneous	50	19.2
Total	261	100.0

Off-Farm Income

The average income from outside sources was $13,585. Eighty-four percent of this income came from the operators' and spouses' salaries. The remainder came from family allowances, net self-employed income, investment, pensions, etc.

PLANNED CHANGES

Beef was the major enterprise engaged in by part-time farmers. Of those with beef cows, 37 percent indicated that they planned to increase their beef herd while 40 percent indicated no planned changes; 14 percent made no comment and 9 percent said they planned to decrease the enterprise. There was some discouragement among those with a beef enterprise. Several said that they planned on selling all livestock if prices did not improve. Some also thought that they would increase beef cattle production if prices were better. Others were optimistic that prices would improve and felt they would stay with the enterprise. This optimism is especially interesting since beef prices have been particularly low during the past few years and during the production year prior to the interviews. Most of the operators who had dairy cows planned no changes. Of those with sows, 53 percent planned to increase the enterprise from its

TABLE 27. FUTURE PLANS OF PART-TIME FARMERS BY ENTERPRISE, NOVA SCOTIA, 1977

Enterprise	Operators Reporting Enterprise	Future Plans							
		Increase		Decrease		No Change		No Comment	
	– No. –	– No. –	– % –	– No. –	– % –	– No. –	– % –	– No. –	– % –
Beef Cows	167	62	37	15	9	66	40	24	14
Dairy Cows	45	5	11	3	7	21	47	16	35
Goats	15	2	13	–	0	10	67	3	20
Steers	98	28	29	7	7	42	43	21	21
Sows	19	10	53	3	16	2	11	4	20
Market Hogs	21	13	62	2	10	6	28	–	0
Ewes and Lambs	30	18	60	–	0	8	27	4	13
Hens	41	7	17	1	2	16	39	17	42
Bees	7	6	86	–	0	1	14	–	0
Rabbits	7	3	43	–	0	3	43	1	14
Pleasure Horses	78	3	4	3	4	34	44	38	48

present average size of 7.2. Sheep was the other enterprise in which a high percentage (60 percent) indicated planned expansion (Table 27). The average size of ewe flock was 40.5.

For the majority of crops, the highest percentage of respondents planned no changes (Table 28). Of the 98 percent with hay, 25 percent indicated that they planned to expand their acreage which averaged 36.3 acres; 32 percent made no comment and only 4 percent said they were going to decrease it. The major cereal grain was oats. Thirty-two percent grew this crop, with an average acreage of 10.9; 25 percent said that they planned to increase the acreage; the majority (53 percent) planned no changes. Mixed grain was the next most popular crop; the majority of farmers (73 percent) planned no changes.

Those interviewed who grew blueberries were happy, mostly because of favorable prices during the last few years. Fifty percent planned to increase their acreage, 36 percent planned no changes, and 14 percent made no comments on their plans.

PROBLEMS ASSOCIATED WITH PART-TIME FARMING

Because of low beef prices and insufficient production from capital invested, low financial return was the major problem listed by part-time farmers. This problem was

TABLE 28. FUTURE PLANS OF PART-TIME FARMERS BY CROPS, NOVA SCOTIA, 1977

Crop	Operators Reporting Crop	Future Plans							
		Increase		Decrease		No Change		No Comment	
	– No. –	– No. –	– % –	– No. –	– % –	– No. –	– % –	– No. –	– % –
Oats	85	21	25	12	14	45	53	7	8
Barley	14	3	21	3	21	5	37	3	21
Mixed Grain	29	4	25	3	10	21	73	1	3
Wheat	4	1	25	1	25	1	25	1	25
Buckwheat	5	2	40	1	20	2	40	–	0
Winter Rye	2	1	50	1	50	–	0	–	0
Potatoes	22	2	9	4	18	12	55	4	18
Vegetables	32	2	6	4	12	14	44	12	38
Blueberries	22	11	50	0	0	8	36	3	14
Strawberries	14	7	50	1	7	4	29	2	14
Apples	30	8	27	2	7	14	46	6	20
Hay	257	65	25	10	4	101	39	81	32
Haylage	4	1	25	–	0	3	75	–	0
Corn Silage	16	4	25	10	6	10	63	1	6
Tillable Pasture	219	30	14	10	5	76	34	103	47
Wood	219	2	1	30	14	66	30	121	55

closely associated with a major concern for too much machinery and equipment needed for small acreage and the amount of production they could generate. In general, the lack or the inadequacy of custom work services made it difficult to overcome the machinery problem. If custom service was available, part-time farmers were usually last to receive the service because of the small fields and amount of business the custom operator would pick up at that stop. Forty-two percent of the respondents bought used machinery in an effort to keep capital costs down. Several did their own repairs on the used machinery and ensured that they were properly maintained. A number tried to operate with as little machinery as possible. Some respondents either shared machinery or exchanged labor for machinery or a combination of both sharing labor and machinery. In several cases they just planned on subsidizing the machinery costs with their off-farm income.

Another major problem associated with part-time farming was the conflict of the farm work with off-farm employment. There was insufficient time to get the many projects that needed attention on the farm and the farm work done on time. After working all day at the job, the basic chores were about all that the operator felt like doing. There was also not enough time for planning the farm operation and seeking needed information from agriculture extension workers and others. When these people are available, the operator is usually working and when the operator is available, the offices are closed for the evening or weekend. Over 50 percent of the part-time farmers interviewed listed this as a conflict.

Locating the farm in the first place was also a problem which probably resulted in difficulties later. The lack of an adequate listing service made it necessary for the buyer to travel the roads and knock on doors. Not knowing the market and available farms resulted in some choices which probably would not have been made with adequate information. There was also a problem with location and price. The better farms in the more favorable locations were priced out of reach, causing the buyer to select his farm according to price rather than desirable farm characteristics.

There were also problems financing farms, especially in the last few years. About ten years ago, the loan limit of $20,000 with the Nova Scotia Farm Loan Board enabled a person to get a fairly decent part-time farm. Inflation, however, since the inception of this program, has dramatically reduced its usefulness. This caused buyers to obtain financing from mortgage companies at the higher interest rates. The high cost of credit for operating capital and for machinery purchase was also raised.

To overcome low financial returns, the part-time farmers felt that it was necessary to increase production and productivity through clearing and improving land, managing resources more efficiently and altering unprofitable enterprises. Despite these measures, many felt that it would still be necessary to supplement the farm income with off-farm income.

SOME POLICY ISSUES

Government Policies

Several respondents felt that government policies were designed more for the commercial farmer than for the part-time farmer. A number of provincial and federally-provincially shared policies have eligibility clauses which prevent the majority of part-time farmers from taking advantage of them. Some examples are Capital Grants, Land Improvement, Commercial Loans from the Nova Scotia Farm Loan Board, Manure Storage Grants, Hog Production Incentive. Interest Subsidy, Interest Forgiveness, Beef Production, and Sheep Production. The policies generally specify that the farmer must receive the majority of his income from farming or have a gross farm income of $10,000 or more (in some policies $5,000). These clauses eliminate the majority of part-time farmers who participated in this study.

Another policy issue prevents part-time farmers from obtaining sufficient funds at a low interest rate to purchase their farms and to make improvements. The $20,000 limit for part-time farm loans through the Nova Scotia Farm Loan Board was thought to be too low since it was set over 10 years ago. This low limit generally forced them to take private mortgages at much higher rates. The interest rate for the part-time farm loans with the Board was felt to be fair.

Other problems raised were machinery costs and the higher interest rates associated with purchasing machinery. The operators felt that there was little they could do about high machinery costs, but that something could be done about high interest rates. Because of the large requirement for borrowed funds, larger commercial farmers can obtain more competitive rates than part-time farmers. Guaranteed farm machinery loans was suggested as a possible solution.

Extension

Part-time farmers ranked other farmers as one of their major sources of information. Although provincial agri-

culture workers were ranked almost as high an information source, they felt that the thrust of extension programs was not aimed at the part-time farmers. When information was sought from agricultural representatives and other specialists, however, full cooperation was received. The time commitments of off-farm employment did not enable a majority of part-time farmers to use the services of the various agricultural government departments. This has implications, as far as an extension program is concerned, not only for part-time farmers but for extension personnel. Part-time farmers are available on evenings and weekends for courses and receiving extension specialists at their farms, but these times are not usually suitable to extension specialists. This same conflict exists, for example, with service personnel from private feed companies. Some part-time farmers also felt that extension workers were more prepared for delivering extension programs to the commercial farmer and found it difficult to present programs and information suitable for their size of farm and level of technology. They felt that paraprofessionals, such as other farmers who had time available in the winter or retired farmers hired on a casual basis, could be useful in an extension program.

SUMMARY AND OBSERVATIONS

This paper was prepared to provide information about part-time farming which might be useful to organizations and agencies concerned with agricultural development, and to present and prospective part-time farmers.

A substantial number of Nova Scotian farmers work off the farm. Based on the 1976 census, 39 percent of farmers reported off-farm work and 25 percent worked off the farm 127 days or more.

Most of the information obtained for the study was derived from on-farm interviews with 261 part-time farm families in Nova Scotia. Additional information was obtained from Statistics Canada publications.

The study dealt with the basic farm structure of part-time farmers, the reasons for engaging in part-time farming, the background characteristics of part-time farm families, the off-farm work engaged in and the implications for part-time farming, the future plans of part-time farmers, their sources of technical farming information and the ways in which they are attempting to solve their problems.

Some salient observations of the study are as follows:

- Part-time farming has been an important aspect of agriculture in Nova Scotia since its early settlement.
- The percentage of census farm operators reporting off-farm work has decreased slightly in the last 25 years; however, those who are working off the farm are doing so for longer periods.
- Approximately 25 percent of census farm operators are essentially employed full-time off the farm (i.e., 127 days or more).
- The average age of part-time farmers is 45 years, and 78 percent of the farm operators are under 55. This corresponds exactly with the figure published by Statistics Canada in the 1976 census. Fifty-four percent of full-time farmers are under 55 years of age.
- Based on Statistics Canada data part-time farmers reporting 127 days or more of off-farm work control 9 percent of the value of agricultural products sold, 18 percent of all improved land, and 18 percent of total capital.
- The majority of part-time farmers (66 percent) and 47 percent of their spouses also have farm backgrounds.
- Seventy-eight percent of those interviewed were born in Nova Scotia and 88 percent were born in Canada.
- Forty-nine percent of part-time operators completed eight years in school. The remaining operators were more heavily weighted to the higher grades, giving rise to an average of 10 years completed in school. Beyond grade school, 47 percent had no further training and of those who did, little of the training was in agriculture.
- A desire to live in the country was ranked first as the reason for engaging in part-time farming. "To get started in farming" and "to increase income" were also high on the list. Closely linked with the desire to live in the country was the thought that it was a good place to bring up children.
- Involvement in agricultural production is a long-term goal of part-time farmers which gives an aspect of permanence to their existence and their agricultural involvement.
- The majority of part-time farmers (59 percent) obtained their farms in the past 10 years.
- Part-time farmers have a favorable equity position and have, in fact, decreased their debt load since they purchased their farms, a possible indication of low risk taking and farm subsidization with off-farm earnings.
- No particular occupation was associated with part-time farming. A high percentage (approximately 90 percent) had rather inflexible time requirements.

- Beef cattle was the most popular enterprise associated with part-time farming, partly because of the labor requirement fitting in well with off-farm work.
- A major problem associated with part-time farming was insufficient production to warrant the required capital investment.
- Conflict between farm work with off-farm employment is another major problem.
- Efficiency and technology gaps exist on part-time farms, partly because not enough income is generated to cover cash costs.
- The majority of part-time farmers is ineligible for some major federal and provincial government support programs.
- Because of part-time farmers' off-farm work commitments, conflicts exist with the delivery of an intensive extension, program by the provincial Department of Agriculture, and improved service from agri-business.

ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE – SEPTEMBER 1978

Item	Units or Base	1975 Annual	1976 III	1976 IV	1976 Annual	1977 I	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II
Production and Income												
1. GNP at Market Prices[a]	$ mil.	165,428	193,072	198,184	191,492	202,852[b]	207,956[b]	212,308[b]	217,412[b]	210,132[b]	223,312	230,100
2. Farm Cash Receipts Total[d]	$ mil.	10,028.5	2,503.4	2,361.5	9,975.0	2,660.0	2,222.9	2,624.3	2,664.8	10,171.9	2,904.0	2,705.6[c]
3. – Total Crop[d]	$ mil.	4,802.1	1,141.5	959.4	4,621.7	1,427.0	754.5	1,107.5	1,140.0	4,429.0	1,468.8	1,004.7[c]
4. – Total Livestock Prod.[d]	$ mil.	4,817.9	1,265.9	1,244.3	4,996.3	1,142.7	1,308.6	1,393.4	1,401.1	5,245.8	1,354.6	1,608.6[c]
5. Net Income rec'd by farm operators[a]	$ mil.	4,107.0	3,080.0	2,804.0	3,551.0	2,800.0	3,656.0	2,940.0	2,744.0	3,035.0	3,056.0	4,248
Trade												
6. Real Dom. Prod., Ag.[a]	1971 = 100	91.7[b]	107.7	101.5	104.2	95.5	100.6	104.2	104.8	101.3	103.8	102.9
7. Real Dom. Prod. Less Ag.[a]	1971 = 100	119.9[b]	126.4	127.4	125.9	129.3	129.4	130.2	131.1	130.0	132.0	133.1
8. Agricultural Exports	$ mil.	3,940.0	1,015.0	1,035.0	3,960.0	941.0	1,115.0	1,120.0	1,088.9	4,264.9	945.4	NA
9. Agricultural Imports	$ mil.	2,892.0	759.0	836.0	3,129.0	867.0	980.5	827.5	880.9	3,555.8	876.6	NA
Price Indexes												
10. Farm Input Price Index	1971 = 100	162.9	172.9	172.3	172.9	175.6	181.2	181.3	181.7	180.0[c]	187.3	196.7
11. – Buildings & Leasing	1971 = 100	153.5	172.2	175.8	170.7	177.9	180.8	186.7	190.0	183.9	193.4	199.6
12. – Machinery & Motor Veh.	1971 = 100	140.7	152.6	157.2	153.1	159.9	163.7	165.0	169.1	166.4	172.6	174.1
13. – Crop Production	1971 = 100	226.7	206.1	205.0	210.1	207.8	210.6	214.1	214.5	212.5	216.3	221.2
14. – Animal Production	1971 = 100	162.1	165.2	166.2	165.1	162.0	173.2	169.3	165.2	167.4	178.0	203.7
15. – Hired Farm Labor	1971 = 100	165.1	193.1	200.7	189.8	203.2	207.0	211.0	213.0	208.6	214.5	217.9
16. – Interest		204.7	242.4	242.4	242.4	242.8	242.8	242.8	242.8	242.8	242.8	242.8
17. Farm Prices of Ag. Prod.[d]	1961 = 100	231.6	220.1	209.9	222.6	213.1	222.1	218.8	216.4	217.6[b]	222.2[bf]	234.6[f]
Input and Credit												
18. Farm Implement and Equipment Sales	$ mil.	966.3	396.0	256.0	1,134.1	163.7	298.3	331.3	283.3	1,124.6	381.7	294.6
19. Employment In Agriculture[a]		479,000	538,000	459,000	474,000	459,000	461,000	529,000	464,000	468,000	431,000	487,000
20. Av. Farm Labor Rates[d]	$/hr.	2.91	3.36	3.42	3.27	3.49	3.54	3.61	3.66	3.56	3.67	NA
21. Av. Hourly Earnings-Manuf.	$/hr.	5.06	5.79	5.97	5.76	6.16	6.34	6.44	6.57	6.38	6.69	6.77[c]
22. F.C.C. – Gross Loan Disburs.	$ mil.	412.0	95.7	83.1	443.0	77.8	129.9	175.7	125.4	508.8	78.4	127.8
23. F.I.L. – Loans Made	$ mil.	212.8	44.3	25.3	159.9	24.9	51.6	53.1	34.1[c]	163.7	37.8[c]	NA

continued

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE – SEPTEMBER 1978 (CONCLUDED)

Item	Units or Base	1975	1976			1977					1978	
		Annual	III	IV	Annual	I	II	III	IV	Annual	I	II
24. CPI – All Items	1971 = 100	138.5	140.8	143.7	148.9	155.5	159.1	162.6	166.1	160.8	169.2	173.3
25. – Food at Home	1971 = 100	161.6	164.5	162.6	164.1	168.0	175.9	182.7	188.6	178.8	194.8	208.3
26. – Food Away from Home	1971 = 100	162.5	177.7	180.5	176.3	184.1	185.8	188.3	190.0	187.0	192.6	194.9
27. Industry Selling Price Index – Food and Beverage	1971 = 100	170.9	174.8	173.0	173.7	178.8	187.3	187.9	189.2	185.9	194.9	203.9
Other												
28. Unemployment Rate[a]	%	6.9	7.3	7.5	7.1	7.8	8.1	8.2	8.4	8.1	8.4	8.6
29. Exchange Rate	$U.S.	1.02	0.98	.99	0.99	1.03	1.05	1.07	1.10	1.06	1.11	1.13
30. Av. Rate on New Demand Loans	%	9.8	10.6	10.7	10.6	9.1	9.1	8.6	8.7	8.9	8.7	9.7
31. Quarterly Population Est.	Mil.	22.80	23.03	23.39	22.99	23.18	23.24	23.32	23.39	23.29	23.44	23.50

[a]Seasonally adjusted at annual rates.
[b]Revised.
[c]Preliminary.
[d]Excludes Newfoundland.
[e]Not available.
[f]Based on current initial prices only for wheat, oats and barley in Alberta, Saskatchewan and Manitoba.

NOTES

AN EVALUATION OF THE DAIRY FEED FORMULATION SERVICE

The following is reproduced from a bulletin of the University of Guelph and the Ontario Ministry of Agriculture and Food. It was written by H.W. Caldwell of the Ontario Agricultural College's School of Agricultural Economics and Extension Education.

Introduction

The Dairy Feed Formulation Service began in 1975 as a joint project with the Ontario Ministry of Agriculture and Food, the Canfarm Service Agency, and the University of Guelph. A computer program is used to ascertain the least cost dairy ration for a particular dairy farm. A farmer using the service provides information on a standard form known as the "input form." Information such as the breed of cattle, production levels, the feed available on his farm, a list of the feeds available to purchase, etc., is forwarded together with information on his own feed supply to the Feeds Laboratory at the Animal and Poultry Science Department, Ontario Agricultural College, University of Guelph. If the farmer does not know the quality of his own feed he can enclose samples to be analyzed for nutrient content. The data are processed, and a feeding guide is prepared based on the information received. This feeding guide provides a recommendation for a ration based on the least cost combination of the feeds available which the farmer can use for his specific herd.

In 1976 the service was tested in Ontario by the Extension Branch of the Ontario Ministry of Agriculture and Food with some modifications being made as a result. By October 1, 1976 the service was fully operational. Presently it is being used extensively in Ontario and to a lesser degree in British Columbia, Manitoba, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. Approximately 1,400 farmers are using the service.

In 1977 Brian Little undertook a study under the supervision of H.W. Caldwell to ascertain the extent to which those on the service were using the recommendations, and also to obtain the opinions of those who implemented the recommendations on the effects of the change on production, herd health, etc. The respondents were asked how they became aware of the service and what had influenced them to adopt it. It was thought that this information would be helpful to those responsible for administering the program, both in increasing its use and in making modifications if such were deemed necessary as a result of the information gained.

Because of the large number of users, it was decided that a random sample of approximately one third of the users would give a reasonable coverage. As a result, 380 questionnaires were sent out and 189 were returned completed, to be analyzed at Guelph.

This was a good response rate, as some farmers felt that they had not been long enough on the service to be sure of the effect of the changes made.

Summary of the Findings

The study found that the majority of users of the Feed Formulation Service had been farming over 10 years and had generally received their knowledge of dairy nutrition from practical experience. The predominant dairy breed of the respondents was Holstein, with the largest number of herds falling in the range of 30 to 39 cows each.

The majority of users became aware of the service through O.M.A.F. personnel. The majority also discussed their Feeding Guides with them. Most of the respondents felt that the Feeding Guide was easily understood, although a few would like additional help with the interpretation and application of the information received.

Seventy-two percent of the respondents used the guide with little deviation from the recommendations. Seventy-eight percent indicated that the recommended rations were somewhat different from what they had been feeding. If it can be assumed that some of the respondents had not changed as a result of the recommendation, because no change was necessary, it is assuring to these producers that their present ration was a good one.

Effect on Production

There was a fairly even split between those who had an increase in production after using the recommended ration and those who did not. Forty-five percent indicated that they had not noticed an increase while 44 percent indicated that they had. It is interesting to note that the average production per cow of dairy farmers

was estimated to be 36 to 40 pounds a day, with an average 3.7 percent butterfat test.

Effect on Herd Health

The question did not bring forth specific answers; nearly half (45 percent) thought there was no change while the other answers ranged from great improvement to one who thought there had been a great reduction. Many of the respondents recognized the effects might take some time to be evident and replied that they had not been on the program long enough to tell.

Effect on Income

Sixty-four percent of the respondents indicated that the implementation of the feeding guide recommendations had increased their income, either as the result of their increased production or decreased costs or both. It might also have been the result of reduced health problems in some cases. Again, for many, the service had not been in effect long enough for them to be sure of the effect on the farm income. It is helpful to note that 81 percent of the users experienced satisfaction with the service, while 11 percent did not answer. Some indicated that they did not know how to respond as it was too early to tell. One of the most frequently stated reasons for dissatisfaction was the length of time required for receiving the recommendation from the time the information had been submitted. Forty-nine percent thought that 14 days should be long enough. Only 6 percent had received the feeding guide in a period shorter than 14 days.

Suggestions for Improvement

When asked to comment or make suggestions for improvement in the service, 36 percent expressed satisfaction with it as is and an additional 15 percent commented that it was too early to make suggestions for change. However, several made suggestions such as "the service was too slow and should be speeded up," "the minerals were listed in too small quantities, making it difficult to mix," "the protein should be listed as digestible and non-digestible," and "a cost comparison with different mixes would be helpful." Some also suggested that additional help to interpret the recommendations would be useful and that there might be some explanation or comments included with the recommendation. Two users asked that the service become part of the Dairy Herd Improvement Program.

PUBLICATIONS

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An Examination of the Small-Open-Economy Hypothesis for Canadian Exports. Benjamin W. Wurzburger. July 1978. 24 p. *Available free from the Bank of Canada, Distribution Section, 239 Wellington St., Ottawa, Ontario, K1A 0G9.*

Farm Credit Corporation Annual Report 1977-78. June 1978. 32 p. *Available free from Farm Credit Corporation, Halldon House, 2255 Carling Ave., 6309 Postal Station 'J', Ottawa, Ontario, K2A 3W9.*

For a Common Future – A Study of Canada's Relations with Developing Countries. Economic Council of Canada. *Available for $4.50 from Publications, Canadian Government Printing Office, Supply and Services Canada, 45 Blvd. Sacré-Coeur, Hull, Quebec, K1A 0S7.*

The GATT Negotiations 1973-79: The Closing Stage. Sidney Golt. May 1978. 52 p. *Available for $3.00 from the C.D. Howe Research Institute, 1155 Metcalfe Street, Montreal, Quebec.*

1978 Directory, Agriculture. 1978. 127 p. *Available free from the Nova Scotia Department of Agriculture and Marketing, Nova Scotia Agricultural College, P.O. Box 550, Truro, Nova Scotia, B2N 5E3.*

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Protection; and Prices, Profits and Productivity in Thirty-Three Canadian Manufacturing Industries. Tim Hazledine – Economic Council of Canada. April 1978. 28 p. *Available free from Publications, Canadian Government Printing Office, Supply and Services Canada, 45 Blvd. Sacré-Coeur, Hull, Quebec, K1A 0S7.*

Report by the Tariff Board Pursuant to the Inquiry Ordered by the Minister of Finance Respecting Fresh and Processed Fruits and Vegetables: Volume 2, Processed Fruits and Vegetables, Statistical Tables. The Tariff Board. *Available for $15.00 from Publications, Canadian Government Printing Office, Supply and Services Canada, 45 Blvd. Sacré-Coeur, Hull, Quebec, K1A 0S7.*

Retention of the Crow Rate and the Alberta Livestock Economy. Dr. G.A. MacEachern. April 1978. 58 p. *Available for $10.00 from the Agricultural Economic Research Council of Canada, 100 Bronson Avenue, Suite 1007, Ottawa, Ontario, K1R 6G8.*

A Structural Analysis of the Canadian Economy to 1990. May 1978. 50 p. *Available free from Economic Analysis Branch, 4th Floor West, Department of Industry, Trade and Commerce, 235 Queen Street, Ottawa, Ontario, K1A 0H5.*

Time Management in Farming. February 1978. 14 p. *Available free from Extension and Rural Development Division, Saskatchewan Agriculture, Regina, Saskatchewan.*

Trade and Depictable Resources: The Small Open Economy. Richard Harris. 1978. 32 p. *Available for $1.00 from Queens University, Kingston, Ontario, K7L 3N6.*

Western Hemisphere Agricultural Situation, Review of 1977 and Outlook for 1978. May 1978. 37 p. *Available free from the U.S. Department of Agriculture, Washington, D.C. 20250, United States.*

IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we will try to accommodate you.

When forwarding your "In Reply" or letter, indicate if we may publish your comments in a subsequent issue.

G. Labrie, 121 Petite Rivière, Louiseville, Québec, found G.J. King's article "The Use of Aircraft in Agriculture," in our April issue, very useful. He said that farmers were just beginning to use aircraft for their operations in his area, and that the article answered many questions often asked of him.

C.F. Bentley, 13103-66 Ave., Edmonton, Alberta, said that "The Economics of Increasing Crop Productivity in Ontario and Quebec by Tile Drainage Installation" by H.T.M. Colwell, in our June issue, had ". . . very pertinent data giving not only drainage costs, but a basis for estimating resulting maximum possible increase in production." It also gave ". . . a very important general review which should be updated at least every other year . . ." as the scene changes.

Robert M. Plank, Assistant Regional Manager, Farm Credit Corporation, P.O. Box 249, Kelowna, British Columbia, wrote that "The Energy Demands of Agriculture" by I.F. Furniss in our June issue was well written, informative, timely, and important. He also said that CFE is an informative and important publication for agriculture.

Lester Settle, Secretary-Manager, N.S. Federation of Agriculture, Box 784, Truro, Nova Scotia, also liked the Furniss article, and would like to see more regional material, especially on electrical energy.

IN REPLY TO AUTHORS AND EDITORS REGARDING OCTOBER 1978 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) Management for Increased Productivity in Dairy Farming
(2) Economic Analysis of Crop Rotations in Western Canada
(3) Part-Time Farming in Nova Scotia

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

not useful 1 2 3 4 5 6 7 8 9 10 very useful

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:
LINEAR		
inch	x 25	millimetre (mm)
foot	x 30	centimetre (cm)
yard	x 0.9	metre (m)
mile	x 1.6	kilometre (km)
AREA		
square inch	x 6.5	square centimetre (cm^2)
square foot	x 0.09	square metre (m^2)
acre	x 0.40	hectare (ha)
VOLUME		
cubic inch	x 16	cubic centimetre (cm^3)
cubic foot	x 28	cubic decimetre (dm^3)
cubic yard	x 0.8	cubic metre (m^3)
fluid ounce	x 28	millilitre (ml)
pint	x 0.57	litre (ℓ)
quart	x 1.1	litre (ℓ)
gallon	x 4.5	litre (ℓ)
WEIGHT		
ounce	x 28	gram (g)
pound	x 0.45	kilogram (kg)
short ton (2000 lb)	x 0.9	tonne (t)
TEMPERATURE		
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius (°C)
PRESSURE		
pounds per square inch	x 6.9	kilopascal (kPa)
POWER		
horsepower	x 746	watt (W)
	x 0.75	kilowatt (kW)
SPEED		
feet per second	x 0.30	metres per second (m/s)
miles per hour	x 1.6	kilometres per hour (km/h)
AGRICULTURE		
gallons per acre	x 11.23	litres per hectare (ℓ/ha)
quarts per acre	x 2.8	litres per hectare (ℓ/ha)
pints per acre	x 1.4	litres per hectare (ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare (ml/ha)
tons per acre	x 2.24	tonnes per hectare (t/ha)
pounds per acre	x 1.12	kilograms per hectare (kg/ha)
ounces per acre	x 70	grams per hectare (g/ha)
plants per acre	x 2.47	plants per hectare (plants/ha)

CANADA DEPARTMENT OF AGRICULTURE
OTTAWA, ONT.
K1A 0C5

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VOLUME 13 NUMBER 6 DECEMBER 1978

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. EUGENE WHELAN, MINISTER – GAÉTAN LUSSIER, DEPUTY MINISTER

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AN ECONOMIC ASSESSMENT OF ZERO TILLAGE IN WHEAT-FALLOW ROTATIONS IN SOUTHERN ALBERTA

The economic feasibility of using herbicides to replace mechanical tillage operations was assessed for two- and three-year spring wheat rotations at Lethbridge, Alberta. The results indicate that moisture conservation, grain yields, and erosion resistance can be improved with zero tillage. In addition, substantial savings in labor, fuel and oil, machine repairs, and overhead costs can be achieved. Widespread adoption of zero tillage will, however, depend on individual farm characteristics and whether producers can purchase effective herbicides for less cost than the savings in labor and machinery services coupled with the increased returns from the higher yields.

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INTRODUCTION

Widespread producer acceptance of technological change in agriculture has traditionally taken many years. Notable exceptions have been the licensing of new crop varieties, the application of commercial fertilizers, and the expanding use of agricultural chemicals.

An agricultural technology that has recently entered western Canadian agriculture is the concept of zero tillage cropping. This concept involves planting a crop in a seedbed that has not been tilled since planting the previous crop. Weeds are controlled with appropriate herbicides.

The concept of zero tillage was first successfully practised in the United States as early as 1944 (Lonbard 1944). The practice has since become very popular, particularly in the cornbelt region, with over 3.25 million ha of cropland currently being managed with zero tillage systems (Anonymous 1978).

About 15 years ago, researchers in the semiarid regions of western Canada and the northwestern United States began to study the zero tillage concept and its effectiveness in controlling soil erosion and reducing soil moisture losses that often plague dryland farmers. Their intentions were to establish principles under which herbicides could substitute for some or all of the tillage, realizing that the best herbicides then available were too expensive to be of practical use to producers. Their research did show that with zero tillage surface residue, moisture conservation, yields, and other physical and chemical soil characteristics were equivalent or superior to conventional tillage systems (Molberg and Hay 1968, Anderson 1971). Some studies, however, have shown that moisture conservation and yields were reduced with minimum and zero tillage but this was often attributable to poor weed control with the available herbicides (Black and Powers 1965, Molberg *et al.* 1967, Bentley *et al.* 1978).

With the recent availability of effective new herbicides, dryland grain producers in western Canada can consider zero tillage as a possible alternative to conventional practices. For individual producers, however, it remains to be seen under which conditions zero tillage may be profitable.

This study examines the economic feasibility of producing spring wheat under zero tillage practices in the prairie region of western Canada. Specifically, it was designed to measure the differences in resource require-

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ments (e.g., labor, fuel and oil, and machine repairs) between various conventional tillage methods and zero tillage wheat-fallow rotations. As well, it was designed to estimate maximum expenditures that farmers could afford for herbicides under the zero tillage rotations at various prices for labor and wheat.

DATA SOURCE AND THE EXPERIMENT

This study used data collected in a field-scale experiment at the Agriculture Canada Research Station, Lethbridge, Alberta, from 1968 to 1976.

The experimental site consisted of 10 adjacent fields, each measuring 22 m by 187 m. Two two- and two three-year rotations involving conventional and zero tillage practices were established on the fields, without replication. Each field was divided (split-plot design) to permit planting with two types of conventional seeder. Soil at the site is classified as Lethbridge silt loam of the Orthic Dark Brown Chernozem soil group.

A wide-blade cultivator was selected as the major tillage implement for the conventional tillage rotations because it is considered to be the best machine for trash conservation (Anderson 1961). Herbicides used for the zero tillage rotations were limited to those having no residual effect on subsequent crops. Paraquat, a non-selective herbicide, was the main herbicide used to control weeds before planting and during the fallow season. Several applications were generally required during the fallow season to achieve effective weed control. Fall or early spring applications of 2,4-D were used to control winter annual weeds on chemically-treated fallows.

The rotations studied were as follows:

1. spring wheat-fallow (wide-blade cultivator as the major tillage implement),
2. spring wheat-fallow (herbicides only for weed control),
3. spring wheat-spring wheat-fallow (wide-blade cultivator as the major tillage implement), and
4. spring wheat-spring wheat-fallow (herbicides only for weed control).

All conventional tillage areas received two tillage operations with a heavy-duty cultivator and rod weeder attachment for seedbed preparation. No seedbed preparation was performed for zero tillage rotations; herbicides were applied to control weeds before seeding. All fields were planted to spring wheat at 67 kg/ha with a semi-deep furrow drill (23-cm row spacing) and a double-disc press drill (18-cm row spacing). Fertilizer was not applied on fallow or recropped plots in any of the years. Herbicides for wild oats – barban and benzolyprop ethyl – and 2,4-D were used when necessary for in-crop weed control. For yield determination at maturity, the fields were threshed with a self-propelled combine. Straw was distributed with a paddle-type spreader attachment on the combine.

METHOD OF ANALYSIS

The analysis was done in two stages. In the first, differences in resource requirements (e.g., labor use, fuel and oil, and machine repairs) were calculated between the conventional tillage rotations (rotations 1 and 3) and the zero tillage rotations (rotations 2 and 4). These differences included the costs associated with fallow preparation, seedbed preparation, planting, in-crop weed control, harvesting, and transporting and storing the grain. Differences in overhead costs (i.e., investment and depreciation) were estimated for the conventional tillage and zero tillage rotations.

In the second stage, break-even prices for herbicides, that equated the net revenue from wheat production under conventional tillage and zero tillage rotations, were calculated using three prices for labor ($0, $5, and $10 an hour) and three prices for wheat ($110, $147, and $184/t). These break-even values represented the maximum expenditures for weed control with herbicides under the zero tillage method that would be competitive with conventional tillage methods.

A 600-ha case farm with a typical machinery complement was selected for analysis. A farm-level simulation model of dryland crop production that included the major physical, biological, and economic variables required for the evaluation of new dryland farming technologies was used (Zentner *et al.* 1978). The model was modified to accommodate the particular machine operations and sequences used in the experiment for each rotation and year.

To determine differences in overhead costs between the conventional tillage and zero tillage rotations, those machines that were not required for the zero tillage rotations were removed from the farm inventory (i.e., heavy-duty cultivator, wide-blade cultivator, and large tractor). Machine repair and depreciation functions used in the model are reported in Andruchow and Shortreed (1976). Prices for fuels were set at $0.12/L for diesel and $0.15 for gasoline. Prices for in-crop herbicides were set at $2.35/ha for broadleaf herbicides and $12.97/ha for post-emergence wild oat herbicides. Prices for other inputs and resources were representative of 1978 conditions.

RESULTS AND DISCUSSION

Under the conventional tillage rotations, an average of 5.4 tillage operations were required for effective weed control during the fallow season. Under the zero tillage rotations, an average of 4.3 applications of herbicide were required to control weeds on fallow for the two-year rotations and 5.4 applications for the three-year rotations. In-crop herbicides were required in seven of the nine years for all rotations; however, in some years (Table 1) heavy wild oat infestations resulted in significant yield losses.

The wide-blade cultivator was effective in conserving plant residue on the soil surface during the fallow season. Loose and anchored surface residue after fallow averaged 1288 kg/ha under conventional tillage. This is the minimum amount of surface residue required to prevent soil erosion (Lindwall 1977). Under zero tillage, nearly all of the plant residue remained in an upright, anchored position throughout the fallow period, thus providing excellent erosion protection. Surface crop residue after zero tillage fallow averaged 2710 kg/ha.

Available soil moisture at planting averaged about 18 mm more on fallow and about 10 mm more on stubble under zero tillage than for conventional tillage. At the time of planting, soil tests for nitrogen and phosphorus on the fallow and stubble plots were similar for conventional and zero tillage. Despite evidence of a nitrogen deficiency, stubble plots were not fertilized. This enabled easier assessment of tillage and seeding practices.

The two types of conventional seed drill used in the experiment performed satisfactorily for the zero tillage operations under most conditions (Lindwall and Anderson 1977). The semi-deep furrow drill experienced $15.98 for each ha of land cropped using zero tillage some problems with plugging, resulting in shallow penetration and poor seed placement, when large quantities of loose surface residue were present. The double-disc press drill also had some problems with penetration and seed placement, particularly on stubble land. Yields of grain, however, did not show any significant difference because of the type of seed drill used during the study. For this reason, average yields from fields planted with the semi-deep furrow and double-disc press drills were used.

Spring wheat yields were generally higher with zero tillage than with conventional tillage on both fallow and stubble (Table 1). The yield advantages with zero tillage were attributable mainly to greater moisture conservation and shallower seeding.

Total resource requirements (excluding herbicide expenditures for weed control on fallow and before planting) were lower for zero tillage than for conventional tillage. For the two-year rotations, zero tillage required an average of 80.7 percent of the resources required for conventional tillage, when labor was valued at $5 an hour. Similarly, for the three-year rotations, zero tillage required lower total resources (83.7 percent) than conventional tillage at the same price for labor.

Seasonal labor requirements, particularly during the spring and summer, were reduced substantially using zero tillage (Table 2), with greater savings under the two-year rotation than the three-year. Fuel and oil and machine repair costs were also substantially reduced for zero tillage. These resource savings averaged for the two-year rotations and $9.41 for the three-year rotations, when labor was valued at $5 an hour. In addition, savings in overhead costs totalled $14.75 for each ha of land cropped using zero tillage for the two-year rotations and $11.06 under the three-year rotations. These resource savings, however, do not include the added cost of herbicides required to control weeds on fallow or before planting on areas being cropped.

TABLE 1. SPRING WHEAT YIELDS BY ROTATION AND YEAR ON UNFERTILIZED FIELDS

Rotation	1968	1969	1970	1971	1972	1973	1974	1975	1976	Mean	S.D.[a]
						kg/ha					
Two-Year Rotation											
Conventional Tillage											
– Fallow	1812	2304	1550	1705	2089	1375	1348	2385	2075	1846	384
Zero Tillage – Fallow	2116	2257	1967	1819	2345	1617	1078[b]	2405	2116	1967	418
Three-Year Rotation											
Conventional Tillage											
– Fallow	1644	2122	1240[b]	1550	2149	1307	1590	2500	2277	1819	451
– Stubble	1078	701	755	364[b]	1294	438	748	1779	755	876	431
Zero Tillage – Fallow	1927	1954	2374	1624	2533	1415	1051[b]	2405	2365	1961	505
– Stubble	1469	782	768	1038	1314	620	1004	1846	1233	1118	384

[a]Standard deviation.
[b]Heavy wild oat infestations depressed yields.

TABLE 2. COMPARISON OF RESOURCE REQUIREMENTS FOR ZERO TILLAGE AND CONVENTIONAL TILLAGE, 1968-76

Resource	Two-Year Rotations (Zero Tillage as Percent of Conventional)	Three-Year Rotations (Zero Tillage as Percent of Conventional)
Labor — Spring[a]	75.1	62.2
Summer[b]	44.6	66.3
Fall[c]	83.6	92.8
Total	71.7	79.7
Fuel and Oil	57.9	71.9
Machine Repairs	52.9	62.7

[a]Includes labor required for all activities before May 21 of each year.
[b]Includes labor required for all activities between May 21 and August 20 of each year.
[c]Includes labor required for all activities after August 21 of each year.

Zero tillage has an economic advantage over conventional tillage only if the savings in labor and machinery costs, combined with the greater returns from the increased crop yields, more than compensate for the added cost of herbicides. In the experiment, paraquat was the main herbicide used because of its efficacy and non-residual effect on the crop, and because it was the only herbicide of its kind when the experiment was started. As used in the experiment, however, it was not economical. Fewer applications or use of other herbicides now available may be equally or more effective.

In the second part of the analysis, break-even prices for herbicides using zero tillage were analyzed. The break-even price was defined as the maximum expenditure that could be made for herbicides for controlling weeds during the fallow season and before planting, to produce the same net revenue from the conventional and zero tillage practices at a particular price for labor and wheat.

Break-even prices for herbicides using zero tillage for the two-year rotations were positive (Table 3). In other words, some money was available for purchasing herbicides under all labor and wheat price situations considered. The break-even prices rose with increases in

TABLE 3. BREAK-EVEN PRICES FOR HERBICIDES UNDER THE TWO-YEAR ZERO TILLAGE ROTATION[a]

Price for Wheat	Price for Labor ($ an Hour)		
	0	5	10
$/t	–	$/ha	–
110	36.95	43.27	49.60
147	41.32	47.65	53.97
184	45.70	52.02	58.34

[a]Break-even prices include an overhead cost saving of $14.75/ha cropped.

the price for labor because less labor was used. They also increased as the price for wheat increased because of the yield advantage over conventional tillage.

Break-even prices for herbicides using zero tillage for three-year rotations displayed patterns similar to those under the two-year rotations (Table 4). As the price of wheat increased, the break-even prices for chemical weed control before planting on stubble fields increased at a faster rate than the break-even prices for fallow fields. This was caused by the yield differential between stubble and fallow using zero tillage compared with conventional tillage (i.e., a yield advantage of 242 kg/ha on stubble versus 128 on fallow). It should again be pointed out that neither stubble nor fallow fields were fertilized for this study. Optimum fertilizer application might magnify or mask yield differences resulting from different tillage systems.

If producers are able to purchase effective herbicides for less cost than the break-even prices, then zero tillage has an economic advantage over conventional tillage. It is apparent from these results that zero tillage may be more practical in the recropping phase of a rotation than for the fallow phase because of the low herbicide requirements (one application before seeding) and the relatively greater yield advantage.

SENSITIVITY OF RESULTS

Two factors that influenced the results of this study are the age of the machines and the size of the farm selected for the analysis. Farms with newer machines

TABLE 4. BREAK-EVEN PRICES FOR HERBICIDES UNDER THE THREE-YEAR ZERO TILLAGE ROTATION[a]

Price for Wheat	Price for Labor ($ an Hour)					
	0		5		10	
	Fallow[b]	Stubble[c]	Fallow[b]	Stubble[c]	Fallow[b]	Stubble[c]
$/t	–			$/ha		–
110	35.10	36.33	40.73	38.01	46.30	39.69
147	40.24	45.15	45.87	46.83	51.50	48.51
184	45.37	53.97	51.00	55.65	56.64	57.33

[a]Break-even prices include an overhead cost saving of $11.06/ha cropped.
[b]Break-even prices refer to the maximum expenditures that could be made for herbicides to control weeds on the fallow during the fallow period and before planting.
[c]Break-even prices refer to the maximum expenditures that could be made for herbicides to control weeds on stubble land before planting.

have lower repair costs, thus reducing the profitability of zero tillage relative to conventional systems; however, the higher investment and depreciation costs associated with newer machines increase the relative profitability of zero tillage practices. The net effect of new machines on the profitability of zero tillage depends mainly on the relative changes in overhead and repair costs.

Large farms generally have lower overhead and operating costs per unit area than smaller farms because of economies of size (Johnson 1977). Consequently, zero tillage practices might be more profitable for smaller than for larger farms because more resources per unit area may be released or saved.

Machine repair costs were about 18 percent lower for all rotations when new machines were used on the case farm. Hence the savings in resources were reduced under the zero tillage rotations by $2.91 for each ha of land cropped for the two-year rotation and $1.68 for the three-year rotation. Using zero tillage, savings in overhead costs increased $9.60 for each ha of land cropped for the two-year rotations and $7.21 for the three-year rotations, when new machines were considered. As a result, break-even prices for herbicides averaged $6.69 higher for each ha using zero tillage for two-year rotations and $5.53 higher for the three-year rotations, under all price situations when new machines were considered.

Resource and overhead cost savings per unit area using zero tillage were higher when a 360-ha farm was considered instead of a 600-ha farm. The savings in labor, fuel and oil, and machine repairs averaged $1.88/ha more for the two-year rotations and $1.04 more for the three-year rotations (when labor was valued at $5 an hour). Overhead cost savings, using zero tillage, were higher for the 360-ha farm than for the 600-ha farm. For the two-year rotations, savings averaged $5.34 more for each ha of land cropped and for the three-year rotations averaged $3.98 more. Break-even prices for herbicides using zero tillage averaged $7.21/ha more than for the two-year rotations and $5.01/ha more than for the three-year rotations (when labor was valued at $5 an hour). The break-even prices were affected more by the price for labor on the 360-ha farm than on the 600-ha farm because of the greater savings in labor.

SUMMARY AND CONCLUSIONS

This study examined the economic feasibility of using herbicides to replace mechanical tillage operations under two spring wheat rotations at Lethbridge, Alberta. The results show that substantial savings in labor, fuel and oil, machine repairs, and overhead costs can be achieved with zero tillage. In addition, higher grain yields resulting from greater moisture conservation, and improved soil erosion control resulting from greater quantities of surface residue after fallow, make zero tillage a potentially attractive alternative to conventional practices. Adoption of zero tillage, however, will depend on many individual farm characteristics and whether or not producers can purchase efficacious herbicides for less cost than the break-even prices estimated in the study.

Further investigation of agronomic and economic aspects of zero tillage under various crops, rotations, soil types, herbicide programs, with and without the application of commercial fertilizers, is required before recommendations for widespread adoption of zero tillage should be made. Available results suggest that zero tillage has the greatest potential in a recropping system where herbicide requirements are low and yield advantages are substantial.

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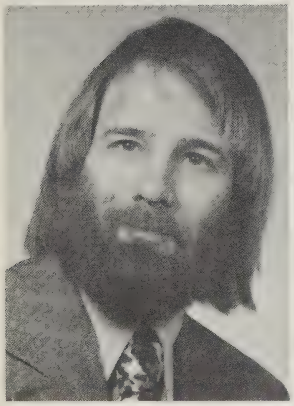
MARGINS IN THE DAIRY PROCESSING INDUSTRY

This article compares the gross margins of Canadian cheese and butter-powder manufacturers with those of U.S. dairy processors. Earlier Canadian estimates of the gross margins of U.S. and Canadian dairy processors may have exaggerated the extent that Canadian gross margins per hL of milk exceed those of the United States. The main reason for this error resulted from underestimating the U.S. milk-to-product conversion factors, thus underestimating U.S. gross margins.

After modifying the conversion factors, the average gross margins for the U.S. dairy processors are still below those of Canadian processors, especially for butter and powder. This article looks at the economic factors that appear to allow U.S. dairy processors to survive on the lower gross margins, namely better capital utilization, lower input costs, and more extensive economies of scale.



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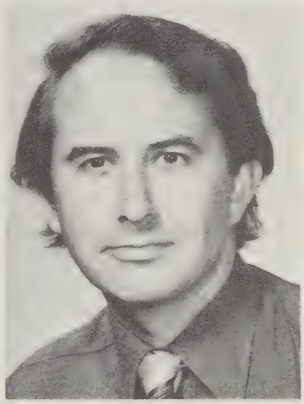

INTRODUCTION

Since World War II, the Canadian dairy processing industry has been characterized by many small firms transporting fresh milk to nearby processing plants. In addition, an unstable milk supply flowed to cheese and butter plants, as they were the last users to receive milk and were highly competitive in their bidding to obtain it (9 and 11). In the summer peak production period plants receive milk to the limit of their capacity, and in the winter there are severe shortages. Since the demands of the fluid processors are satisfied first, primarily because milk for fluid uses commands a higher price, the peaking in the milk supply to cheese and butter processors is more exaggerated than the seasonal peaking of the milk production itself. The relatively stable supply of milk to fluid manufacturers is guaranteed by provincial milk marketing boards, so the non-fluid manufacturers do not always receive the milk supplies that they would like (9).

The number of cheese and butter plants in Canada has been declining during the last decade. For example, in Ontario the number of cheese plants fell from 132 to 69 between 1968 and 1974; likewise, the number of creameries dropped from 95 to 43 (9). At the same time the average size of the plants remaining in the industry is increasing; for example, the number of processing plants (creameries plus cheese factories) in Ontario handling a throughput of over 29 000 t of milk increased to 20 in 1974 from eight in 1968 (9). In Quebec the number of industrial milk plants fell from 65 in 1973 to 42 in 1976.

The reduction in the number of dairy processing plants in Canada is similar to the U.S. situation, except that the consolidation of plants began earlier in the United States (7 and 13). What is different about the Canadian situation is that the total production of butter and

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cheddar cheese is falling. While the U.S. production of all cheese increased 96 percent between 1960 and 1974, and that of cheddar 84 percent (7), the Canadian output of manufactured dairy products has decreased. From 1972 to 1976, Canadian butter production dropped from 136 000 to 114 000 t, and cheddar cheese from 87 000 to 76 000 t, while the manufacture of other cheeses increased from 26 000 to 48 000 t (17).

DAIRY PROCESSING COSTS

The dairy processing industry is characterized by several factors that make the study of cost functions for individual dairy products difficult. Most importantly, the industry manufactures joint goods from a single primary material input – milk. For example, skim milk powder is a by-product of butter manufacture, and various whey products are by-products from the manufacture of cheese. Moreover, many other dairy products can be made simultaneously with cheese or butter at the most modern and integrated processing plants.

In addition to the production of joint goods at the plant level, the industry is vertically integrated so that there are many inter-plant transfers of products at various stages of fabrication. Within a single company, these inter-plant transfers are made at cost and the only information that can be obtained (sometimes even for the company itself) is the total value added from all operations. Furthermore, a large proportion of the administration, transportation, and capital costs of the dairy processing industry is shared among the various products. Accordingly, data on product costs and other aspects of the dairy industry tend to be incomplete or inconsistent (10). Hence, individual product processing costs are usually estimated indirectly.

One estimation method relies on the calculation of a gross margin of revenue over milk input costs. This method differs from many calculations of gross margins in that no attempt is made to deduct all variable costs from total revenues; rather, the cost of only one input – milk, is deducted from the total revenues of the processed dairy products. The purpose of this is to concentrate on the spread between the producer receipts and the processor receipts. Accordingly, the gross margins to the processors are defined as:

$$G = P_P \cdot C - P_M \quad (1)$$

where: G = the gross margin per hL (100 L) of milk to the processors,
P_P = the price per kg of a particular product,
P_M = the price per hL of milk to the processors, and
C = the conversion factor or the amount in kg of a single, well-specified product that can be manufactured from a hL of milk.

The dairy industry's conversion to the metric system has resulted in milk being measured by volume (in hL) instead of weight. However, cheese, butter, and milk powder will be sold by weight (in kg). (For converting weight to volume, one hL of milk weighs 103 kg.)

The methodology is clearly sensitive to the conversion factors which are defined as amounts of manufactured product as a function only of the milk input. In other methods the conversion factors could be estimated as a function of labor or some other input; hence, the usefulness of defining conversion factors on one input depends upon the objective of isolating that input from the others in the manufacturing process. For purposes of examining the price spread between the farm gate and the wholesaler, it is reasonable to isolate the milk from the other processing costs by means of the processing conversion factors.

These conversion factors play an important role in government forecasting of demand for milk, and in administrative pricing formulae used in the milk producing and processing sectors. However, the conversion factors in the dairy processing industry are not unique. They vary considerably among plants, among regions, and particularly between the United States and Canada. There are five general ways in which the conversion factors can be affected.

First, the conversion factors depend on all the inputs used to manufacture a product, and changes in the use of non-milk inputs, such as labor, may affect the quantity of final output of a given product that is manufactured from the milk. Second, the conversion factors for any given product are affected by the mix of by-products that are also manufactured from the basic input – the milk; for example, some products, like ice cream, require more butterfat than others, like skim milk, thus reducing the amount of cheese or butter that could be manufactured from a given amount of milk. Third, the physical technology affects the amount of butterfat and non-fat solids that can be extracted from the milk; that is, the physical technology determines the extent to which the milk can be processed. Fourth, the quality of the milk coming into the plant directly affects the conversion factors; most importantly, the quantity of cheese or butter that can be produced from

a hL of milk increases as the butterfat content of the milk increases. Finally, there are slight differences in the physical composition of dairy products. For example, some cheddar cheese has a slightly higher moisture content than other cheese given the same name. The process making the moister cheese would display a higher conversion factor. Thus, the conversion factors are not unique but dependent upon the exact inputs and outputs of each plant. Nevertheless, to make general comparisons of gross processing margins it is necessary to estimate average conversion factors for the groups of plants being compared.

GROSS MARGINS IN DAIRY PROCESSING

The current methodology, described by Equation (1), was used to estimate the gross margins for Ontario processors of cheese (and its by-products – whey powder and whey butter) and butter (with by-products of skim milk powder and buttermilk powder), and to compare the margins with those of Wisconsin processors from January 1973 to June 1976. Throughout that period the estimated gross margins for Ontario processors of cheese (and its by-products – whey remained fairly stable for periods of several months and gradually increased in steps. The calculated U.S. gross margins displayed much greater fluctuations, including the appearance of negative gross margins for butter and powder during four months of 1973-74. Generally, the estimated gross margins for butter and powder in Ontario were about twice those of Wisconsin, and gross margins for butter and all by-products were about 1.7 times those of Wisconsin. For cheese alone, Ontario margins were estimated at about 1.7 times larger than Wisconsin's, and gross margins for cheese plus all by-products were calculated to be about 1.3 times larger in Ontario. Moreover, a faint trend was observed that showed the gross margins for all of the dairy products studied increasing more quickly in Ontario than in Wisconsin.

To illustrate the calculated gross margins, an example was selected using June 1976 data for cheddar cheese. Cheese rather than butter and powder was chosen because the joint goods problem, though still present, is much less severe with cheese.

The June 1976 wholesale price for cheddar cheese in Ontario was $2.47/kg. The price of a hL of class 5a milk (the class of milk used in the manufacture of cheese and butter) to the processing plants was fixed at $19.75. It was assumed that 9.36 kg of cheddar cheese could be manufactured from a hL of milk in Ontario. Hence, the gross margins to the plants were calculated to be [($2.47) × (9.36) – $19.75] or $3.37/hL of milk.

In Wisconsin the wholesale price of cheddar cheese in June 1976 was $2.05; the milk cost $18.56/hL and the Wisconsin conversion factor was estimated at 9.92 for cheddar cheese. The estimated gross margin was [($2.05) × (9.92) – $18.56] = $1.77. Thus, the Canadian gross margin for cheddar cheese alone appeared to be almost twice the U.S. margin. When additional alowances were made for all of the by-products, as well as the cheese itself, the total gross margins for Canada were still calculated to be 1.66 times higher in June 1976.

The accuracy of the current parameters in the gross margin methodology was checked in two ways. First, the accuracy of the prices and conversion factors used was verified. Second, independent estimates of the gross margins to the plants, especially for U.S. processors, were sought.

The Canadian prices, set by the Canadian Milk Supply Management Committee, were easily verified. It was more difficult to verify the U.S. prices, because they are determined more by the market mechanisms and vary slightly from plant to plant according to the available supplies of milk. Although the exact time series of prices used could not be reconstructed exactly, discussions with dairy experts in the United States at private plants, at the United States Department of Agriculture (USDA), and at many universities, as well as an examination of the prices used in studies of the U.S. dairy processing industry (1, 2, 7, and 12), indicated that the prices to and from the U.S. plants were very close to those assumed.

The conversion factors, on the other hand, could not be validated. Private consultation with U.S. dairy experts and an examination of published and unpublished studies (6, 7, 12, and 13) show that the assumed U.S. conversion factors may be too low, thus understating U.S. gross processing margins. This is true for both cheddar cheese and for butter and powder. Specifically, a more realistic estimate of the average conversion factor for cheddar cheese processing plants in northern U.S. states is 10.4 kg of cheese per hL of milk instead of 9.92. Likewise, the conversion factors for butter and powder for U.S. plants are closer to 4.61 for butter and 8.37 for non-fat dry milk rather than the 4.40 and 8.24 that are assumed.

For the U.S. conversion factors all sources of information tended to support the average conversion factors stated above. There was less agreement for Canadian

plants. Dairy experts in Canada believed that the Canadian conversion factors were about the same as those currently employed in the methodology. Dairy experts at the USDA were skeptical that conversion factors for Canadian plants were as low as those presently assumed. But there is some evidence that even modern Canadian integrated processing plants operate on conversion factors lower than those assumed by the parameters of the methodology. For cheese, the revealed conversion factor at one large plant in Quebec was 9.16. A study of nine Ontario cheese processing plants by Murchie-Stewart (11) in 1969 showed that the conversion factors for those plants ranged between 8.76 and 9.15, an average of 8.99. In that study the average butterfat content of the milk going into the plants was untypically low (3.54 percent on a weight for volume basis). An informal sampling of Ontario plants in 1977 indicated that the milk then being received was about 3.6 percent weight for volume (equivalent to 3.5 percent on a weight to weight basis). A simple proportional scaling of the Murchie-Stewart results based on a butterfat content of 3.60 percent would lead to a 1976 Ontario conversion factor of 9.14 for cheese.

The butterfat content of milk received at processing plants has shown a tendency to fall over the long term. This will reduce the amount of butter which can be made from a hL of raw milk. Industry experts in Canada believe that the conversion factor may now have fallen to 4.22 from the 4.40 volume for volume that Statistics Canada uses.

Returning now to the example of gross processing margins for cheddar cheese in June 1976, and using the modified Canadian and U.S. conversion factors, the Wisconsin cheese processors would receive a gross margin of [($2.05) × (10.4)] – $18.56 = $2.76. The Ontario plants would receive [($2.47) × (9.14)] – $19.75 = $2.83.

Moreover, a review of many U.S. studies indicates that the U.S. gross processing margins are in accordance with our modified estimates of them as above (1, 6, 7, 8, 12, and 13). For example, a common estimate for gross processing margins for cheddar cheese in northern U.S. states in 1975 was $2.32 to $2.50/hL of milk. This was supported by information from a plant (12), from a U.S. university study (7), and from discussions with dairy experts at the USDA. An annual average estimate of Wisconsin cheese margins for 1975 using the gross margins methodology with the conversion factor modified to 10.4 is $2.50.

The modified conversion factors are summarized in Table 1. It must be emphasized that more study is needed to obtain the exact Canadian conversion factors for both cheese and butter and powder, and that this can only be done with actual primary data from the plants. Canadian conversion factors are now being reviewed by Agriculture Canada's minister's committee on dairy statistics, and it is apparent, because of understating U.S. margins, that the current method's parameters overstate the extent of the differences between the gross margins of U.S. and Canadian dairy processors. Even if the conversion factors currently used in the method for Canadian plants are correct, much of the apparent discrepancy disappears if the U.S. conversion factors are modified. And if the modified Canadian conversion factor for cheese used in the example above is approximately correct, then the difference in the gross margins for cheese is less than one cent/kg of cheese. The difference in the estimated gross margins for butter and powder between Wisconsin and Ontario processors is reduced more than 60 percent by correcting the U.S. and Canadian conversion factors. There still remains a significant difference, however, between U.S. and Canadian gross processing margins for butter and powder.

TABLE 1. MILK CONVERSION FACTORS (KG OF PRODUCT PER HL OF MILK)

Product	Ontario Dairy Processors		Wisconsin Dairy Processors	
	Previous	Modified	Previous	Modified
Cheddar Cheese	9.36	9.14	9.92	10.40
Butter	4.40	4.22	4.40	4.61
Skim Milk Powder	8.24	8.24	8.24	8.37

HIGHER U.S. CONVERSION FACTORS

There are two basic reasons why the conversion factors are generally higher for the U.S. plants: the milk coming into the plant is different, and the manufactured products are slightly different. The input differences constitute by far the most important reason.

The single most significant factor is that the butterfat content of milk received by U.S. non-fluid dairy processors averages about 3.78 percent weight for volume (7), while milk for Ontario plants may be as low as 3.60 percent butterfat, although the Canadian average is nearer to 3.68 percent. In addition, discussions with U.S. and Canadian dairy experts indicate that the non-fat milk solids are also higher in U.S. milk. The U.S. and Canadian butterfat content of milk has shown a downward trend for many years because of a decline in the high fat breeds and the increase in the milk yield per cow, which tends to lower fat con-

tent. The total non-fat milk solids going to the U.S. plants are higher on an annual average basis because there is more winter milk in the United States. Since the Canadian milk production pattern has a higher proportion of spring and summer milk, which cattle produce mainly by grazing, the Canadian milk has on the average a higher water content. That is, allowing dairy cattle to feed primarily on grass in the spring and summer reduces the proportion of solids in the milk.

Because a higher proportion of U.S. cheddar cheese is used for further processing (processed cheese) than Canadian (5, 7, and 16), the average U.S. cheddar requires less aging. Hence, the U.S. cheese on the average has a slightly higher moisture content. Discussions with dairy experts in Canada and the United States indicate that the moisture content of U.S. cheese is about 37 to 38 percent, while that of Canadian cheddar is approximately 36 to 37 percent.

LIMITATIONS OF A GROSS MARGINS METHODOLOGY

It has been shown that updating the conversion factors for Ontario and Wisconsin dairy processors did not entirely explain the differences in gross processing margins seen in the mid-seventies, especially for butter and powder. Accordingly, it is appropriate to consider three economic factors that would account for higher gross margins for Canadian processors: capital utilization, manufacturing costs, and economies of scale.

First, better capital utilization can be achieved at the U.S. plants because their inflow of milk displays less seasonal variability. Although both U.S. and Canadian producers have flattened the seasonal peaking in milk production in the last eight years, the U.S. production has less seasonal variation, and averages around a ratio of 52:48, summer-to-winter production. In contrast, Canadian summer-to-winter production of manufacturing milk hovers around a 70:30 ratio. Hence, the under-utilization of plant facilities is less at U.S. plants in the non-peak periods, which is most of the year. As the plants become larger and more capital intensive, this peaking is more and more of an economic handicap for the Canadian plants.

Second, several manufacturing costs, most notably wages, are lower for U.S. plants (6, 12, 13, and 15). In addition to wage rates being somewhat lower, especially at the managerial level, the U.S. plants have more flexibility for releasing labor when it is redundant and in adding or extending work shifts in the peak production periods (12).

Finally, evidence from Canada and the United States shows that substantial economies of scale exist in the production of both cheese and butter. While neither country is fully exploiting these economies, U.S. plants appear to be ahead in the trend toward consolidation and higher milk throughput. The question of economies of scale is, however, a complex one, and the following section is devoted to a more detailed analysis of Canadian and U.S. differences.

ECONOMIES OF SCALE IN DAIRY PROCESSING

Several studies have recently shown that massive economies of scale exist in the manufacture of cheese and butter and powder (3, 6, 7, 9, and 13). For butter and powder plants they are most obvious. At small scales of butter production (less than 300 t a year) it is possible to survive economically by processing butter primarily from farm-separated cream if that supply can be obtained (3). Since most farmers find it more profitable to sell whole milk, creameries based on farm-separated cream are becoming increasingly rare. For plants using primarily whole milk as input or receiving inputs of milk equivalents in excess of 7 500 t, combination butter and powder plants are economic (3). As far as butter only is concerned,[1] increasing the output from 500 t a year to 1 000 t reduces the average in-plant unit processing costs about 27 percent; average unit costs fall another 16 percent by processing 1 500 t a year; moving to 2 000 t reduces the average unit cost another 7 percent, and the average costs level out thereafter (3). For powder, economies of scale are present but not so pronounced. For either a roller-dried process[2] or a spray-dried process of manufacturing skim milk powder, the average unit costs are reduced about 22 percent by increasing the output from about 800 t to 1 720 t of powder (the equivalent of 500 to 1 000 t of butter). After that scale only the spray-dried method is economic. Doubling production from 1 720 t of powder decreases unit costs again approximately 18 percent (3).

If anything, these figures underestimate the economies of scale because they are based on slightly dated technologies. Recent developments, such as totally automated evaporators and spray driers, automated packaging equipment, self-cleaning cream separators,

[1]In practice, the amount of skim milk powder that must be produced is determined by the level of butter production; manufacturing one kg of butter implies that about 1.9 kg of skim milk powder are processed in a combination plant. However, since the economies of scale are more pronounced for butter production, it is of interest to abstract from the joint goods problem and disaggregate the economies of scale.

[2]Hardly any roller-dried skim milk powder is made today. Less than 18 t were manufactured in 1975.

and high capacity continuous-flow-of-product plants (where the labor requirements are reduced to a few supervisory personnel), indicate that economies of scale will become even more significant (13). A 1972 study of economies of scale in hypothetical U.S. butter and powder plants estimates that the relative economies of scale are significantly larger than the Canadian butter and powder estimates cited above, and that the average unit processing costs do not level off until combination plants have a throughput of about 225 000 t of milk annually, or more than 9 500 t of butter (13). In summary, significant economies of scale are obtainable for combination butter and powder plants up to a scale of 2 000 t of butter a year and probably beyond.

For the manufacture of cheddar cheese, the economies of scale continue at a diminishing rate up to large output levels – at least 7 000 t a year (6 and 7). Since there is a wide variety of cheese-making technologies, the actual economies depend on the technology employed; but the key point is that economies of scale do exist. Plants with outputs below 1 000 t of cheese a year make slim profits at best, and may not be able to cover overhead costs despite the fact that most U.S. and Canadian plants were operating at that level in 1973 (3, 6, and 7). In the long run, firms not covering overhead costs must become more efficient or be forced out of business. Increasing output from 1 000 to 2 000 t can lower average unit costs about 23 percent, and moving to 4 000 t can reduce unit processing costs a further 6 percent (6).

Significant economies in the manufacture of cheddar cheese can be realized at an annual output level of 4 000 t. Some economies can be achieved even at higher levels, and this situation will likely become more pronounced (7).

It is clear that neither Canadian nor U.S. plants are fully exploiting the economies of scale in the manufacture of cheese and butter and powder. However, although there is great variability in the size and efficiency of plants in both countries, the U.S. plants are on the average ahead in capturing the economies of scale. For example, in Minnesota in 1970, 123 butter or combination processing plants were in operation with an average annual output of 1 134 t of butter. U.S. dairy experts believed that a substantially more efficient situation would be 15 to 20 butter and powder plants, each processing an average annual output of 5 500 to 11 000 t of butter (13). Considerable progress has been made toward that objective in Minnesota. In contrast, in 1973 Canada had 242 creameries, all but 44 of which manufactured less than 500 t of butter a year (4); only eight Canadian plants processed more than 2 700 t in that year (4).

A similar situation exists with cheese. In 1972, 73 out of 613 U.S. cheddar cheese plants manufactured more than 2 250 t a year; 11 manufactured more than 9 000 t annually (7). The average production per cheddar cheese plant in Minnesota, which had the highest average plant production in 1973, was 6 200 t; in Wisconsin, which had by far the largest total production of any state, the average plant size was 1 220 t, slightly less than the U.S. average plant production (7). In contrast, out of 128 Canadian cheddar cheese plants in 1973, the production of only 35 was in excess of 450 t (4) and only nine manufactured more than 1 800 t (4).

Figure 1 provides a graphic illustration of the difference in the distribution in the size of cheddar cheese plants between Ontario and Quebec, which together manufacture almost 85 percent of Canadian cheddar cheese, vis-a-vis American plants in the most comparable situation. The curves for the Canadian plants are based on 1973 data (4) while that for cheddar cheese plants in the north-central states is based on 1972 information (7).

Decreasing marginal costs to the plants may be arrested at certain throughput volumes because of increasing milk assembly or transportation costs. As the milkshed grows for each plant as a result of a reduction in the number of plants, the average transportation and other milk assembly costs could increase. Although there are some economies of scale in milk assembly costs, these are more limited than those for the processing costs (13). Moreover, as fuel prices rise and the real costs of transportation increase, rising unit assembly costs will have an even stronger offsetting effect on the economies of scale in processing.

THE OUTLOOK FOR DAIRY PROCESSORS

In the long run, Canadian processors face a difficult adjustment. To compete vigorously with the U.S. dairy manufacturers, the processing plants[3] must be designed around output levels that yield substantial economies of scale. This requires a large and guaranteed throughput of milk. Moreover, since in the dairy processing industry the economies of scale result in a higher proportion of capital costs (7, 13, and 14), the peaking problem becomes relatively more costly, i.e., plant under-utilization becomes relatively more expensive.

To realize the economies of scale, plants must not only have a large and stable throughput but must also be

[3]Certain types of specialty cheeses and aged cheddar can be produced in plants that do not exhibit large economies of scale.

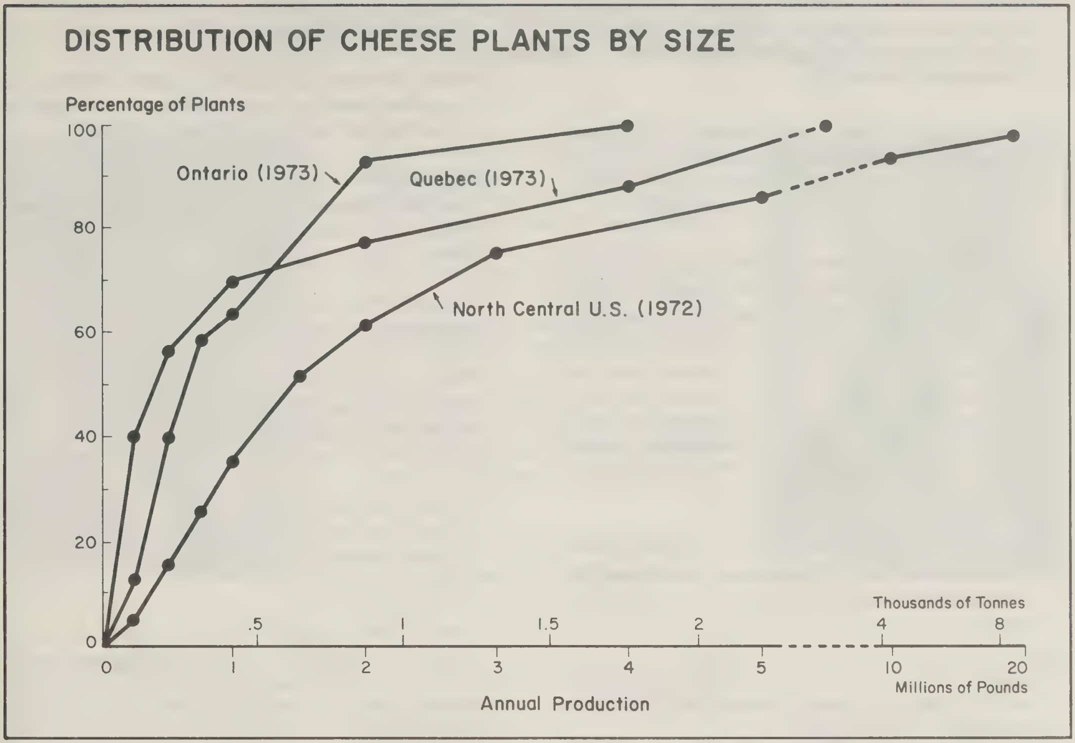

Figure 1

able to secure markets. It is not presently clear that the total market can be expanded, unless new export opportunities are found. Given the two-price system of most dairy-exporting countries (one price for domestic consumption and a much lower one for exports), non-subsidized opportunities for foreign markets are unlikely to materialize.

The existence of economies of scale, however, gives the efficient processors even more incentive to obtain supplies that would otherwise be used by less efficient plants. It is a characteristic of firms facing economies of scale (downward sloping cost-curves) that, given a fixed price for output, expanding throughput at the margin is profitable; hence, with a virtually fixed national milk production, an expanded throughput to the plants capable of achieving economies of scale can for the most part only be achieved by diverting supplies from an existing plant. In Ontario, additional quota must be bought if throughput is to be expanded.

The economies of scale can largely be realized by expanding the throughput to some of the existing processing plants rather than constructing new ones (7, 9, and 11). Nevertheless, several technological improvements can further reduce unit costs (5, 6, 7, 13, and 14), so eventually new investment will have to be attracted to the industry. This study's findings indicate that the consolidation of the Canadian dairy processing plants is not yet complete. The introduction of advanced technology throughout the industry has been and continues to be a major factor in the consolidation of dairy processing plants.

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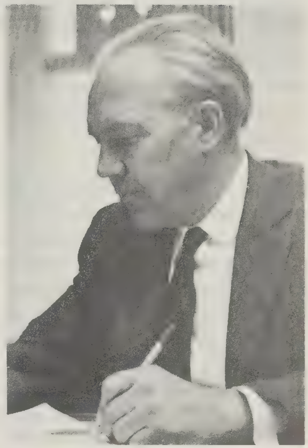
FARMERS' PARTICIPATION IN REGISTERED RETIREMENT SAVINGS PLANS

An increasing number of farmer-taxpayers participated in Registered Retirement Savings Plans during the 1971-74 period. Farmers' decisions to participate in these plans were at least partly influenced by whether or not their sources of the non-farm portion of their total net income and the level of their total net income led to tax-saving advantages. It was also found that a high proportion of farmer participants wished to provide some future family protection and some tax savings if and when incomes increased.



*F.L. Tung and R.S. Rust**

INTRODUCTION

Along with the rapid changes in the Canadian economy and the increasing complexity of farming operations, financial planning for retirement is becoming an increasingly significant part of farm management planning. Some farmers, for example, establish a financial plan for retirement by continuously putting back their savings into farm expansion and thereby generating greater income or equity to finance their needs through the retirement years. Other farmers set up alternative financial plans for retirement by diversifying their savings into non-farm investments such as stock, bonds, debentures, or other non-farm securities.

After the introduction of the Registered Retirement Savings Plans (RRSPs) under the revised Income Tax Act in 1957, farmers were able to establish financial plans for retirement by placing some of their savings in these plans, hence deferring a portion of their income taxes in high income years to the low income retirement years.[1]

Because of their tax-deferring nature, RRSPs might have been used by many farmers in establishing financial plans for their retirement years. Little has been published, however, about the actions farmers take concerning their retirement plans in general and their participation in RRSPs in particular. This paper is therefore directed towards examining farmers' actions in purchasing RRSPs based on taxfiler data for the 1971-74 taxation years. More specifically, the paper deals with two question areas, whether or not there is any significant difference in the rate of participation in RRSPs between farmer and non-farmer taxpayers, and if the tax-saving advantages and the amount of income farmers earned from non-farm sources are significant factors in determining the purchases of RRSPs. If not, what are other possible factors?

An analysis of factual data on the two question areas helped to reveal whether or not farmers consider alternative retirement plans more or less beneficial than RRSPs. In addition, such analysis provides background

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[1]The terms of coverage in RRSPs are complex and are available from various publications. This paper does not duplicate such coverage but the major terms which relate to the analyses presented are in Appendix A. The available publications are listed under References.

for further investigations of the number of farmers who might receive annuity payments and reveal the extent of possible changes in the income level of retired farm operators.

DATA SOURCE, INCOME DEFINITIONS, AND FARMER CLASSIFICATION

Income taxfiler data for the taxation years 1971-74 were used to determine the percentage and the number of farmers by income class who participated in RRSPs during these years.

Several income definitions are used in this paper. Total net business income includes net income returns from farming, including any deemed income for the year, salaries and wages received, professional income, commission income, fishing income, rental income, and other business incomes. Total earned income includes total net business income, company pension benefits, government pension benefits, and alimony and maintenance. Total net income is the sum of all income from all sources, including both earned and unearned incomes. Unearned income includes investment income, family allowances, net capital gains, dividends from taxable Canadian corporations, and other unspecified income.

Taxfilers who reported no farm income source were classified as a non-farm group while all other taxfilers who reported some farm income (either positive or negative) were classified as full-time farmers, commercial part-time farmers, or as non-commercial part-time farmers, according to the following definitions:

- A full-time farmer is a taxfiler whose net farm income was greater than 50 percent of his total net business income.[2]

- A commercial part-time farmer is a taxfiler whose net farm income was between 10 percent and 50 percent of his total net business income.

- A non-commercial part-time farmer is a taxfiler whose net farm income was less than 10 percent of his total net business income.

[2]It was recognized that days of off-farm work would be a better variable for classifying farmers into the normally used terms of full-time and part-time farmers, etc. Such a variable, however, was not available from taxfiler data. Hence net farm income relative to total net business income was used by assuming that a unit of an operator's time devoted to his different business activities would generate the same amount of net income. Given this assumption, higher net farm income relative to total net business income implies that more time was devoted to the farm business. Thus such an operator can then be roughly classified as a full-time farmer.

An alternative method was used to classify those taxfilers who had a negative net farm income. In this situation, a taxfiler was classified as a "full-time farmer" when the tax return indicated a negative net farm income but the value of the farm products sold exceeded $15,000. Taxfilers who had a negative net farm income but sold between $5,000 and $14,999 worth of farm products were classified as commercial part-time farmers, and those who had a negative net farm income and sold less than $5,000 of farm products were classified as non-commercial part-time farmers.

COMPARISON OF RRSP PARTICIPATION RATES BETWEEN FARM AND NON-FARM GROUPS

In 1971 there were 9,533,292 income taxfilers in Canada, of which 366,288 reported some farm income (Table 1). If the latter number represents the total number of farmers in 1971, then the 12,669 farmers who reported having made some contributions to RRSPs in that year represented 3.5 percent of all farmer-taxfilers.[3] The participation rate in RRSPs by the non-farm group in the same year was 3.7 percent.

The RRSP participation rate of all taxfilers was generally low, but it did increase from 1971 to 1974, and the proportion of farmers participating increased faster than that of the non-farm group. This might have been partly due to a faster growth rate in farm income than in non-farm income. Generally, 1972 to 1974 were years of high farm income. In 1974 the proportion of farmers participating in such plans was about 15 percent, while the proportion of the non-farm group was approximately 7.8 percent.

The data in Table 2 indicate that the amount of the average contributions of taxfilers to RRSPs increased during the 1971-74 period. The average contribution of each contributor in the farm group increased from $1,136 in 1971 to $2,264 in 1974, compared with an average increase from $912 in 1971 to $1,265 in 1974 for each contributor in the non-farm group. The total average fund that farmers contributed to these plans represented about 4 percent of the total earned income of all farmers during 1971-74.[4]

[3]The 1971 Census of Agriculture indicated that there were 365,352 farms (excluding institutional farms) and 366,288 farm taxfilers. The totals are not the same since the definitions used in this study of taxfiler data differ from those applied in data obtained from the Census. For more detail see the first entry under References.

[4]The total earned income of farm group taxfilers for the 1971 taxation year was $334 million and for the 1974 taxation year $3,234 million. Total income was $633 million in 1971 and $3,798 million in 1974.

TABLE 1. NUMBER AND PERCENTAGE OF TAXFILERS WHO CONTRIBUTED TO RRSPs BY INCOME CLASS AND BY FARM AND NON-FARM GROUP, CANADA, 1971-74 TAXATION YEARS[a]

	All Taxfilers				Non-Farm Group				Farm Group			
Total Net Income Class	1971	1972	1973	1974	1971	1972	1973	1974	1971	1972	1973	1974
Number of Taxfilers												
Less than $0	96,728	104,365	120,900	96,686	70,895	83,961	105,924	79,844	25,833	20,404	14,976	16,842
$ 1 – $ 4,999	4,836,679	4,926,746	4,747,077	4,363,619	4,608,841	4,719,379	4,579,196	4,223,787	227,838	207,367	167,881	139,832
$ 5,000 – $ 9,999	3,236,566	3,514,549	3,676,872	3,659,141	3,155,885	3,411,811	3,563,585	3,552,395	80,681	102,738	113,287	106,746
$10,000 – $15,999	1,049,892	1,402,673	1,820,312	2,401,390	1,027,694	1,368,327	1,763,615	2,333,253	22,198	34,346	56,697	68,137
$16,000 – $24,999	218,741	308,878	460,089	805,822	212,448	299,271	436,287	768,207	6,293	9,607	23,802	37,615
$25,000 – $49,999	76,065	100,051	143,534	225,278	73,682	96,381	133,585	204,172	2,383	3,670	9,949	21,106
$50,000 and Over	18,621	24,743	35,078	50,234	17,559	23,615	32,765	45,215	1,062	1,128	2,313	5,019
Total	9,533,292	10,382,005	11,003,862	11,602,170	9,167,004	10,002,745	10,614,957	11,206,873	366,288	379,260	388,905	395,297
Number of Taxfilers who Contributed to RRSPs												
Less than $0	149	229	150	252	86	117	58	145	63	112	92	107
$ 1 – $ 4,999	31,319	38,682	40,528	31,404	29,240	36,016	37,671	28,770	2,079	2,666	2,857	2,634
$ 5,000 – $ 9,999	111,517	166,153	208,212	197,675	107,371	158,945	197,843	187,191	4,146	7,208	10,269	10,484
$10,000 – $15,999	107,821	175,983	259,930	315,911	104,599	169,739	247,418	300,446	3,222	6,244	12,512	15,465
$16,000 – $24,999	56,496	99,999	151,276	240,608	54,818	96,639	141,754	255,168	1,678	3,360	9,522	15,440
$25,000 – $49,999	30,823	50,210	76,943	119,479	29,780	48,462	71,585	107,164	1,043	1,748	5,358	12,315
$50,000 and Over	9,549	14,160	20,886	31,056	9,111	13,596	19,627	27,874	438	564	1,259	3,182
Total	347,674	545,416	757,925	936,385	335,005	523,514	715,956	876,758	12,669	21,902	41,969	59,627
Percentage of Taxfilers who Contributed to RRSPs												
Less than $0	0.15	0.22	0.12	0.26	0.12	0.14	0.05	0.18	0.24	0.55	0.61	0.64
$ 1 – $ 4,999	0.65	0.79	0.85	0.72	0.63	0.76	0.82	0.68	0.91	1.29	1.70	1.88
$ 5,000 – $ 9,999	3.45	4.73	5.66	5.40	3.40	4.66	5.55	5.27	5.14	7.02	9.15	9.82
$10,000 – $15,999	10.27	12.55	14.28	13.16	10.18	12.40	14.03	12.80	14.51	18.18	22.07	22.70
$16,000 – $24,999	25.83	32.37	32.88	29.86	25.80	32.32	32.49	29.31	26.66	34.97	40.01	41.05
$25,000 – $49,999	40.52	50.18	53.36	53.04	40.42	50.28	53.59	52.49	43.77	47.63	53.85	58.35
$50,000 and Over	51.28	57.23	59.54	61.82	51.89	57.57	59.90	61.65	41.24	50.00	54.43	63.40
Total	3.65	5.25	6.89	8.07	3.66	5.23	6.74	7.82	3.46	5.77	10.79	15.08

[a]All taxfilers who had reported some farm income sources were classified under Farm Group and all others under Non-Farm Group.

Sources: Special tabulations received from Agriculture Division, Statistics Canada; and Revenue Canada, Taxation, *Taxation Statistics*, 1971-74 taxation years.

TABLE 2. AVERAGE CONTRIBUTIONS PER CONTRIBUTOR BY INCOME CLASS AND FARM AND NON-FARM GROUP, CANADA, 1971-74 TAXATION YEARS[a]

Total Net Income Class	All Taxfilers				Non-Farm Group				Farm Group			
	1971	1972	1973	1974	1971	1972	1973	1974	1971	1972	1973	1974
Total Contributions ($'000)												
Less than $0	71	77	97	120	37	20	43	49	34	57	54	71
$ 1 – $ 4,999	9,171	11,895	13,728	11,340	8,333	10,628	12,268	10,006	838	1,267	1,460	1,334
$ 5,000 – $ 9,999	62,270	98,129	124,128	126,549	59,085	91,642	113,465	115,770	3,185	6,487	10,663	10,779
$10,000 – $15,999	97,988	185,274	261,691	308,715	94,039	176,056	240,219	382,330	3,949	9,218	21,472	26,385
$16,000 – $24,999	71,214	170,912	253,947	385,085	68,467	163,231	228,754	343,819	2,747	7,681	25,193	41,266
$25,000 – $49,999	57,400	130,927	197,546	305,271	55,292	125,370	179,598	262,677	2,108	5,557	17,948	42,594
$50,000 and Over	21,665	47,909	71,460	106,643	20,134	45,361	64,978	94,068	1,531	2,548	6,482	12,575
Total	319,779	645,123	922,597	1,243,723	305,387	612,308	839,325	1,108,719	14,392	32,815	83,272	135,004
Average Contributions per Contributor ($)												
Less than $0	477	336	647	476	427	173	739	339	544	507	589	622
$ 1 – $ 4,999	293	307	339	530	285	295	326	348	403	475	511	506
$ 5,000 – $ 9,999	558	591	596	640	550	576	574	619	768	900	1,028	1,028
$10,000 – $15,999	909	1,053	1,007	977	899	1,307	971	940	1,256	1,476	1,716	1,706
$16,000 – $24,999	1,261	1,709	1,679	1,601	1,249	1,695	1,614	1,427	1,637	2,286	2,646	2,673
$25,000 – $49,999	1,862	2,608	2,567	2,555	1,857	2,587	2,509	2,451	2,021	3,179	3,350	3,459
$50,000 and Over	2,269	3,383	3,421	3,434	2,210	3,336	3,311	3,375	3,495	4,518	5,149	3,952
Total	920	1,183	1,217	1,328	912	1,170	1,172	1,265	1,136	1,498	1,984	2,264

[a]See footnote in Table 1 for taxfiler classification.

Sources: See Sources in Table 1.

SIGNIFICANCE OF EARNINGS FROM NON-FARM SOURCES ON THE PARTICIPATION RATE IN RRSPs

The findings suggest that farmers' decisions to participate in RRSPs were at least partly influenced by earnings received from non-farm sources. The participation rate in RRSPs for non-commercial part-time farmers was considerably higher than that for full-time farmers (Table 3). The rate of participation in RRSPs for full-time farmers increased from 2.7 percent of the total number in 1971 to 9.7 percent in 1974, while for the non-commercial part-time farmers the rate increased from 4.5 percent in 1971 to 18.4 percent in 1974. The participation rate in RRSPs for commercial part-time farmers was 2.5 percent which was somewhat lower than that for full-time farmers. This might have been due to unusually high farm income during most of the period investigated. As a consequence, full-time farmers who derived a large proportion of their total net income from the farm business were in a better position than part-time farmers to participate in the plans.

The distribution of farmers who participated in RRSPs differed greatly among the three groups.[5] Of all farmer participants in 1971, approximately 55 percent were non-commercial part-time farmers, 40 percent were full-time farmers, and about 5 percent were commercial part-time farmers. In 1974 the corresponding proportions were 77, 21, and 2 percent. These data indicate some measure of the significance of earnings from non-farm sources in farmers' decisions on whether or not to participate in such retirement plans. The importance of earnings from non-farm sources might be attributable to earnings from these sources being more predictable than net farm income. As a consequence, non-commercial part-time farmers were in a relatively better position to plan for their retirement through the purchase of RRSPs.

The average yearly contribution for each of the four years studied was greater for the non-commercial part-time farmer group than for the full-time farmer group. There could be several reasons for this, including the possibility that full-time farmers had more options for deferring taxes without using RRSPs. The averages for 1971 and 1974 for the former group were $1,828 and $2,315, while for the latter group the averages were $1,039 and $2,122. While the average contribution of the commercial part-time farmers exceeded that of the above two groups in 1971, 1972, and 1973, their average contribution in 1974 was the lowest of the three groups (Table 4). It appears that the non-commercial part-time farmers were much more involved with RRSPs than full-time farmers, both in terms of the proportion of the group contributing and of the average group contribution. This indicates that decisions to adopt RRSPs as a means of financial planning for retirement was more prevalent among the former group than the latter.

INCOME LEVEL AND PARTICIPATION RATE

The data presented in Table 3 also show that as the level of total net income increased, the rate of participation in RRSPs also increased. The rate of participation in RRSPs, for example, for full-time farmers in 1971 ranged from 0.46 percent for the negative total net income class to 32.08 percent for the total net income class of $40,000-$50,000. Similar relationships between the rate of participation and the level of total net income existed for all three groups for the years investigated. It was also found that the amount of contributions for each contributor increased rapidly as total net income increased (Table 4).

THE EFFECT OF TAX-SAVING ADVANTAGES ON THE PARTICIPATION RATE

The above findings imply that decisions on whether or not to participate in RRSPs are strongly influenced by the tax savings that result. It is also possible, however, that other factors might determine the final outcome. To analyze this situation, all farmers who participated in plans during the period were put into two income classes – those with annual total net incomes less than $10,000 and those with annual total net incomes greater than $10,000. There would generally not be much, if any, tax saving advantages for those having annual total net incomes below $10,000; their marginal tax rates are relatively low after deductions for personal exemptions, dependents, and other standard exemptions. It would appear that the possible tax-saving advantage for this group would not be the most significant factor in deciding whether or not to purchase RRSPs. In 1971 over 63 percent of the full-time farmers who participated in RRSPs were in this class. The corresponding proportion for commercial part-

[5]The percentage distributions of the total number of farmers who participated in RRSPs by different farmer groups during the taxation years 1971 to 1974 are as follows:

	1971	1972	1973	1974
Full-Time Farmers	39.47	29.13	24.24	21.23
Commercial Part-Time Farmers	5.43	4.05	2.56	2.08
Non-Commercial Part-Time Farmers	55.10	66.82	73.20	76.69
Total	100.00	100.00	100.00	100.00

TABLE 3. PERCENTAGE OF FARMER-TAXFILERS WHO CONTRIBUTED TO RRSPs BY INCOME CLASS AND BY TYPE OF FARM OPERATIONS, CANADA, 1971-74 TAXATION YEARS[a]

	Full-Time Farmers				Commercial Part-Time Farmers				Non-Commercial Part-Time Farmers			
Total Net Income Class	1971	1972	1973	1974	1971	1972	1973	1974	1971	1972	1973	1974
Number of Taxfilers who contributed to RRSPs												
Less than $0	39	48	34	31	15	20	24	27	9	24	34	49
$ 1 – $ 4,999	1,242	1,232	1,201	1,016	109	136	128	124	728	1,298	1,528	1,494
$ 5,000 – $ 7,999	1,222	1,607	1,903	1,864	107	131	149	143	1,221	2,492	3,734	3,706
$ 8,000 – $ 9,999	655	891	1,274	1,298	59	94	103	96	882	1,993	3,206	3,377
Sub-total (less than $10,000)	3,158	3,778	4,412	4,209	290	381	404	390	2,840	5,807	8,502	8,626
$10,000 – $11,999	485	698	1,146	1,106	61	82	76	100	786	1,774	3,391	3,983
$12,000 – $13,999	354	482	953	1,087	46	55	94	91	680	1,535	3,260	4,128
$14,000 – $15,999	270	385	771	970	30	47	50	79	510	1,186	2,771	3,921
$16,000 – $17,999	197	243	572	822	35	30	50	64	356	897	2,410	3,432
$18,000 – $19,999	120	160	474	706	25	41	43	56	275	674	1,845	3,034
$20,000 – $24,999	202	270	743	1,343	43	60	63	115	517	985	3,322	5,868
$25,000 – $29,999	51	129	397	797	22	37	55	65	185	520	1,835	3,896
$30,000 – $39,999	73	112	391	795	56	49	78	97	342	553	1,677	4,251
$40,000 – $49,999	34	43	138	373	21	41	47	65	167	284	740	1,987
$50,000 and Over	57	80	176	449	59	65	114	132	322	419	969	2,601
Sub-total ($10,000 and over)	1,843	2,602	5,761	8,448	298	507	670	853	4,140	8,827	22,220	37,101
Total	5,001	6,380	10,173	12,657	688	888	1,074	1,243	6,980	14,634	30,722	45,727
Percentage of Taxfilers who Contributed to RRSPs												
Less than $0	0.46	0.69	0.83	0.88	0.16	0.33	0.53	0.58	0.12	0.33	0.55	0.58
$ 1 – $ 4,999	0.92	1.15	1.50	1.58	0.95	1.65	2.04	2.40	0.90	1.42	1.89	2.13
$ 5,000 – $ 7,999	5.11	5.97	7.18	7.67	3.22	4.42	5.92	6.84	3.76	5.67	7.67	8.32
$ 8,000 – $ 9,999	9.33	10.81	13.00	13.61	5.48	8.09	8.75	9.52	6.86	10.25	13.05	13.41
$10,000 – $11,999	12.85	15.33	17.31	15.32	11.54	12.45	9.84	12.54	10.70	14.44	18.23	18.59
$12,000 – $13,999	16.34	18.20	22.17	22.39	15.09	16.13	18.77	16.08	16.54	20.48	24.20	24.56
$14,000 – $15,999	20.23	23.21	25.68	26.66	15.31	21.47	19.23	20.47	21.01	26.48	30.25	30.46
$16,000 – $17,999	24.03	24.43	28.86	29.69	24.14	23.08	28.58	25.10	25.69	33.02	37.37	35.58
$18,000 – $19,999	23.40	25.32	31.65	33.29	26.05	31.54	34.13	31.12	28.30	38.23	40.89	42.15
$20,000 – $24,999	28.14	31.07	35.07	39.87	26.38	36.59	33.34	41.37	34.94	44.19	49.22	49.74
$25,000 – $29,999	25.25	32.33	40.56	43.44	34.92	45.68	46.22	45.14	37.00	47.58	53.39	57.89
$30,000 – $39,999	31.88	37.09	44.79	47.24	44.10	46.67	52.35	53.01	45.60	53.59	57.75	63.16
$40,000 – $49,999	32.08	37.07	42.34	50.89	30.89	55.41	58.03	54.00	49.41	60.69	61.41	67.00
$50,000 and Over	26.39	33.20	37.77	52.64	38.57	42.49	53.53	51.37	46.47	57.09	59.31	66.54
Total	2.71	3.95	7.11	9.71	2.54	4.32	6.26	7.70	4.52	7.43	13.44	18.39

[a]Classification of farmer-taxfilers into different types of farm operations is in the text.

Source: Special tabulation from Agriculture Division, Statistics Canada.

TABLE 4. TOTAL CONTRIBUTIONS AND AVERAGE CONTRIBUTIONS PER FARMER-TAXFILER BY INCOME CLASS AND BY TYPE OF FARM OPERATIONS, CANADA, 1971-74 TAXATION YEARS[a]

Income Class	Full-Time Farmers				Commercial Part-Time Farmers				Non-Commercial Part-Time Farmers			
	1971	1972	1973	1974	1971	1972	1973	1974	1971	1972	1973	1974
Total Contributions ($'000)												
Less than 0 $	24	29	23	24	6	13	12	16	5	15	19	32
$ 1 – $ 4,999	516	603	633	522	48	67	52	61	274	597	775	751
$ 5,000 – $ 7,999	907	1,363	1,806	1,757	62	76	112	110	767	1,935	3,244	3,239
$ 8,000 – $ 9,999	692	1,022	1,710	1,670	47	82	80	77	711	2,010	3,711	3,926
$10,000 – $11,999	596	972	1,860	1,762	48	91	99	106	814	2,208	4,910	5,630
$12,000 – $13,999	533	814	1,778	2,035	54	74	130	134	795	2,250	5,484	5,847
$14,000 – $15,999	439	737	1,688	2,136	50	79	75	114	622	1,994	5,447	7,618
$16,000 – $17,999	332	554	1,417	2,049	45	51	87	101	515	1,742	5,317	7,696
$18,000 – $19,999	229	394	1,334	1,920	35	92	91	115	445	1,488	4,604	7,562
$20,000 – $24,999	233	746	2,344	4,277	77	149	141	267	837	2,466	9,857	17,279
$25,000 – $29,999	256	404	1,377	2,748	41	110	126	177	323	1,813	5,851	12,802
$30,000 – $39,999	152	383	1,361	2,856	140	168	243	290	693	1,694	5,684	14,965
$40,000 – $49,999	102	144	508	1,399	54	157	164	164	346	984	2,635	7,194
$50,000 and Over	183	276	681	1,695	230	236	1,255	541	1,118	2,036	4,546	10,339
Total	5,134	8,440	18,520	26,852	936	1,444	2,272	2,272	8,263	22,931	62,085	105,879
Average Contributors per Contributor ($)												
Less than $0	608	598	686	764	386	669	502	576	528	613	553	644
$ 1 – $ 4,999	416	489	527	514	441	492	405	490	377	460	507	503
$ 5,000 – $ 7,999	742	848	949	943	575	581	750	767	628	776	869	874
$ 8,000 – $ 9,999	1,057	1,147	1,342	1,287	798	874	775	801	806	1,008	1,158	1,162
$10,000 – $11,999	1,228	1,393	1,632	1,593	782	1,111	1,307	1,061	1,036	1,245	1,448	1,414
$12,000 – $13,999	1,505	1,689	1,866	1,873	1,167	1,339	1,379	1,479	1,169	1,466	1,682	1,659
$14,000 – $15,999	1,627	1,914	2,190	2,202	1,653	1,679	1,506	1,448	1,219	1,581	1,996	1,943
$16,000 – $17,999	1,685	2,280	2,476	2,493	1,296	1,688	1,731	1,578	1,446	1,942	2,206	2,242
$18,000 – $19,999	1,908	2,464	2,815	2,270	1,385	2,233	2,126	2,050	1,617	2,208	2,495	2,492
$20,000 – $24,999	1,155	2,763	3,155	3,185	1,792	2,477	2,245	2,321	1,618	2,504	2,967	2,945
$25,000 – $29,999	5,029	3,134	3,468	3,449	1,868	2,964	2,287	2,718	1,748	2,910	3,189	3,286
$30,000 – $39,999	2,085	3,421	3,480	3,592	2,505	3,425	3,117	2,989	2,027	3,063	3,389	3,520
$40,000 – $49,999	2,993	3,343	3,674	3,751	2,552	3,829	3,482	3,036	2,071	3,465	3,561	3,620
$50,000 and Over	3,209	3,445	3,872	3,775	3,902	3,638	11,005[b]	4,098	3,471	4,859	4,692	3,975
Total	1,039	1,323	1,820	2,122	1,360	1,626	2,483	1,828	1,184	1,567	2,021	2,315

[a]Classification of farmer-taxfilers into different types of farm operations is in the text.
[b]A high average contribution for this income class in 1973 was a result of more than seven contributors having transferred more than $100,000 of pension proceeds to the RRSPs.
Source: Special tabulation from Agriculture Division, Statistics Canada.

time farmers was 42 percent and for non-commercial part-time farmers 41 percent (Table 3).[6]

It was not possible to determine from the information available the reasons why some farmers invested in RRSPs when such purchases were not likely to result in a tax saving. Three factors which might have partly accounted for these purchases are discussed in the remainder of this section.

FAMILY PROTECTION

Some farmers might have purchased life-insured RRSPs to meet farm and household debt payments in case of death, since family protection appears to be a major concern for those farmers investing in RRSPs. Lomberg and Krofta indicated that life insurance protection was used more by low income, middle-aged farmers than by older, well-established farmers in Wisconsin. In their study, 84 percent of those operators who were in their forties purchased life insurance, compared with 75 percent of those respondents in their fifties, and about 50 percent of those 60 years of age or over.

The actual number of farmers who purchased life-insured RRSPs was not available but, as indicated in Table 5, many were young and middle-aged. In 1971, for example, about 55 percent of all farmers participating in RRSPs were from 35 to 54 years of age. This distribution remained relatively constant over the period investigated. If the relationship between the farm operator's age and the number of purchases of life-insured RRSPs in Canada was similar to that revealed in the Lomberg and Krofta study, it is probable (based on data in Table 5) that the majority of farmers having total net incomes of less than $10,000 purchased life-insured RRSPs for family protection with the additional thought that if their incomes grew in the future a tax saving might also be possible.

INCOME FLUCTUATIONS

Year-to-year income fluctuations could be another reason why many low-income farmers invested in RRSPs. This most likely applied to full-time farmers and to a lesser extent to part-time farmers. When farmers purchased inflexible RRSPs in their high-income years they had to continue their plans in low-income years. It is believed (based on data in Table 6) that some farmers who had high incomes had purchased inflexible retirement plans before 1971 and were committed to make annual contributions after their total net income dropped under $10,000. If this is the case, then these farmers would be included in the period investigated. In 1972, for example, 15,496 taxfilers reported income which was $1,000 to $1,999 less than the total net income they had received in 1971. In 1973, 14,103 taxfilers received from $1,000 to $1,999 less total net income than they received in 1972. The fact that some farmers were classified in the category of those having total net income of less than $10,000 for the period under study does not necessarily imply that these same farmers did not previously have substantially higher incomes.

Approximately 30 percent of farm taxfilers had a lower total net income in 1972 than they had in 1971, of which about 4 percent had a decrease in total net business income of $5,000 or more. In 1973 approximately 11 percent of farm taxfilers had a lower total net income than in 1972, and 4 percent of this group also had a decrease of $5,000 or more in total net income. Farmers who experienced an income reduction of $5,000 or more, however, could not be more precisely identified. It is probable that such farm taxfilers likely constituted a very small proportion of those farmers who had a total net income of less than $10,000 and who invested in RRSPs.

RRSPs FOR SPOUSES

Since 1974 a taxpayer has been allowed to purchase an RRSP for his spouse, providing that such a purchase does not exceed his maximum contribution. The participation in 1974 could have resulted from some farmers purchasing spousal retirement plans. Such purchases might only reflect a means of compensating a spouse for contributions made to the work and operation of the farm business rather than any serious thought that there might be a tax-saving advantage. This conjecture, however, could not be verified from the data available.

SUMMARY AND CONCLUSIONS

This analysis of farmers' participation in RRSPs for the taxation years 1971 to 1974 was conducted to study the extent of farmer activity in retirement planning. While it was recognized that RRSPs are only one

[6]The percentages of farmers who contributed to the RRSPs (whose total net incomes were less than $10,000) to the total number of farmers contributing to the plans by farmer group are as follows:

	1971	1972	1973	1974
Full-Time Farmers	63.15	59.22	43.37	33.25
Commercial Part-Time Farmers	42.15	42.91	37.62	31.38
Non-Commercial Part-Time Farmers	40.69	39.66	27.67	18.86
All Farmers	49.63	45.50	31.73	21.28

TABLE 5. NUMBER AND PERCENTAGE OF FARMER-TAXFILERS WHO PARTICIPATED IN RRSPs, BY AGE GROUP, CANADA, 1971-74 TAXATION YEARS

	Number who Participated, by Age Group						Percent who Participated, by Age Group					
Group	<35	35–44	45–54	55–64	65+	Total	<35	35–44	45–54	55–64	65+	Total
Full-Time Farmers												
1971	316	920	1,847	1,568	350	5,001	6.31	18.39	36.93	31.35	6.99	100.00
1972	505	1,207	2,210	1,978	480	6,380	7.91	18.91	34.63	31.00	7.52	100.00
1973	1,004	1,867	3,262	3,218	822	10,173	9.86	18.35	32.06	31.63	8.08	100.00
1974	1,503	2,335	3,929	3,763	1,127	12,657	11.87	18.44	31.04	29.73	8.90	100.00
Commercial Part-Time Farmers												
1971	81	223	237	121	26	688	11.77	32.41	34.44	17.58	3.77	100.00
1972	138	273	298	158	21	888	15.54	30.74	33.55	17.79	2.36	100.00
1973	203	324	358	161	28	1,074	18.90	30.16	33.33	14.99	2.60	100.00
1974	244	373	409	188	29	1,243	19.62	30.00	32.90	15.12	2.33	100.00
Non-Commercial Part-Time Farmers												
1971	882	1,800	2,367	1,675	256	6,980	12.63	25.76	33.91	23.99	3.66	100.00
1972	1,739	3,447	5,129	3,758	561	14,634	11.88	23.55	35.04	25.67	3.83	100.00
1973	3,632	6,646	10,482	8,432	1,530	30,722	11.82	21.63	34.11	27.44	4.98	100.00
1974	5,815	9,897	15,117	12,365	2,533	45,727	12.71	21.64	33.05	27.04	5.53	100.00
All Farmers												
1971	1,279	2,943	4,451	3,364	632	12,669	10.09	23.22	35.13	26.55	4.98	100.00
1972	2,382	4,927	7,637	5,894	1,062	21,902	10.87	22.49	34.86	26.91	4.84	100.00
1973	4,839	8,837	14,102	11,811	2,380	41,969	11.52	21.05	33.60	28.14	5.67	100.00
1974	7,562	12,605	19,455	16,316	3,689	59,627	12.68	21.13	32.62	27.36	6.18	100.00

Source: Special tabulation from Agriculture Division, Statistics Canada.

TABLE 6. NUMBER AND PERCENTAGE OF CHANGES IN TOTAL INCOME OF TAXFILERS REPORTING GROSS FARM INCOME OF $1,200 OR MORE, 1971-73, CANADA[a]

Change in Total Net Income	1972 Taxfilers		1973 Taxfilers	
	No.	%	No.	%
More than $5,000	9,266	3.70	9,032	3.61
$4,999 – $4,000	3,179	1.27	3,131	1.25
$3,999 – $3,000	4,985	2.00	4,943	1.97
$2,999 – $2,000	8,576	3.43	7,966	3.18
$1,999 – $1,000	15,496	6.20	14,103	5.64
$ 999 – $1	34,038	13.59	27,813	11.11
Negative Change Total	75,540	30.19	66,988	26.76
$0 – $ 1,000	56,135	22.43	45,393	18.13
$1,111 – $ 2,000	41,409	16.54	34,099	13.62
$2,111 – $ 3,000	25,961	10.37	23,406	9.36
$3,111 – $ 4,000	16,378	6.55	16,975	6.78
$4,111 – $ 5,000	10,248	4.10	12,762	5.09
$5,111 – $ 6,000	6,816	2.72	9,476	3.79
$6,111 – $ 7,000	4,612	1.84	7,371	2.94
$7,111 – $ 8,000	3,167	1.26	6,000	2.40
$8,111 – $ 9,000	2,274	0.91	4,670	1.87
$9,111 – $10,000	1,622	0.65	3,732	1.49
Greater than $10,000	6,152	2.46	19,441	7.77
Positive Change Total	99,234	69.81	116,338	73.24
Total	174,774	100.00	183,326	100.00

[a]Classification of taxfilers into different levels of changes in total net income was based on the amount of changes in total net income for each individual taxfiler. A taxfiler was classified into the "more than $5,000" group if his total net income in 1972 was reduced $5,000 or more, compared with that in 1971. The result for 1973 presented in the table was based on the 1972 total net income of each individual.

Source: Special tabulation received from Statistics Canada.

method by which farmers can plan for future income after retirement, it was considered an essential starting point for analyzing such activity. The study found that the rate of farm taxfilers' participation in RRSPs was greater than that of the non-farm group. This might have been partly attributable to the fact that the years studied were relatively high farm income years and that the actions of farm taxfilers in planning for retirement might be different in some respects from those of non-farm taxfilers. Since the latter viewpoint could not be verified from the data available, it warrants further investigation.

The analysis did indicate that farmers' decisions to participate in RRSPs were at least partly influenced by the sources of the non-farm portion of their total net income and by the level of their total net income. The significance of earnings from non-farm sources on farmers' decisions on whether or not to participate in RRSPs could be attributable to the stability and predictability of earnings from these sources; this in turn would make it possible for such farmers to do some financial planning for retirement.

The income level of taxpayers was positively related to the participation rate in RRSPs. A large proportion of taxpayers who purchased such retirement plans, however, had a total net income less than $10,000. This in itself implies that tax saving was a minor factor affecting the decisions of these farmers in making RRSP purchases. It was concluded that the main reasons for farm taxfilers participating in this category was to provide some future family protection and to achieve some tax savings if and when their incomes increased. It was also realized that year-to-year income fluctuations possibly affected the statistical data in such a way that a relatively higher proportion of low income farmers appeared to have annually participated in RRSPs than actually did. This would be true if individual participation was sporadic.

An increasing number of farmers purchased RRSPs during the period studied. It could not be determined, under the fluctuating income situations that existed, however, whether these plans or other investment opportunities provided the greatest return to investment. Such comparisons could be valuable to farmers contemplating future participation in RRSPs, but while they are considered to be desirable objectives, they were outside the scope of the present study.

APPENDIX

MAJOR TERMS COVERED IN REGISTERED RETIREMENT SAVINGS

Maximum Contributions and Over-Contributions

The maximum contributions have changed several times since 1957; beginning with the 1976 taxation year they were as follows:

– Taxpayers enrolled in a Registered Employee Pension Plan may contribute up to $3,500 or 20 percent of "earned income"[1] each year, whichever is less (minus their contributions, if any), to the employee's plan.
– Taxpayers who are not members of a Registered Employee Pension Plan (i.e., self-employed) may contribute up to $5,500 each year or 20 percent of "earned income," whichever is less.

A recent amendment to the Income Tax Act provided a penalty tax of 1.0 percent a month on contributions to an RRSP over the maximum contribution of $5,500 for the year, if the excess remained in the plan. The excess amount contributed is not eligible for an income tax deduction. A taxpayer who has contributed less than $5,500 in a tax year but has contributed more than his eligible amount will be notified by an assessment notice from Revenue Canada. In this case, the taxpayer can withdraw the excess without penalty, providing it is withdrawn within two years from the date of over-contributing. If left in the plan to maturity, the excess will be taxed as income on withdrawal. This type of over-contribution eventually results in double taxation.

Withdrawals from an RRSP

Under the terms of the Income Tax Act the plans must mature before the holder's 71st birthday, and the proceeds payable at maturity must be by way of a life annuity or an annuity payable to the spouse or other designated beneficiaries under a joint survivorship clause not exceeding 15 years. No benefit is payable under a plan before maturity except in the form of a "refund or premium" in the event of death. A plan can be de-registered and cancelled at any time, however, and all of the funds withdrawn in cash. A partial withdrawal from an RRSP is also possible by transferring any portion to another plan, then de-registering the original plan. In all cases where RRSP funds are withdrawn, or annuity income is received, the proceeds are regarded as taxable income for the year in which they were received.

[1]Earned income is defined in the text.

Some farmers contend that it is possible to use RRSPs to stabilize their income over time and at the same time to use such plans to reduce their income taxes. A farmer could put his earned income into an RRSP in higher income years and then de-register it in the years of low income. By doing this, an overall tax saving could result and the income flow over time therefore be stabilized. It is doubtful, however, if either of these objectives would be realized since there are fees for establishing an RRSP and also penalties for cancelling a plan. The fees and penalties could exceed the tax savings.

Purchasing an RRSP for a Spouse

Since 1974 a taxpayer has been allowed to purchase an RRSP for his or her spouse, providing that such a purchase does not exceed the taxpayer's maximum contributions. The taxpayer's contributions can be deducted from earned income on tax returns. Funds received from an RRSP purchased for a spouse become taxable income of the spouse. Consequently, a taxpayer's earned income can be split by taking out an RRSP for both taxpayer and his or her spouse. This provision does not increase the maximum allowable contributions but it does give the taxpayer an option to direct part or all of his contributions to the spouse. By doing this the amount of income tax paid by the family over the years might be reduced.

The spousal RRSP is particularly advantageous to a married couple when the taxpayer's spouse has little or no income since the proceeds are attributed to the beneficiary for tax purposes. Before 1976 the spousal type of RRSP increased each year but there was an indication that many of these plans were terminated the following year. Hence conditions pertaining to spousal RRSPs were tightened, making it mandatory that funds put into such a plan could not be withdrawn for at least three years. If the funds were withdrawn earlier than this, the withdrawn funds became the income of the contributor.

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ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE – DECEMBER 1978

Item	Units or Base	1976 III	1976 IV	1976 Annual	1977 I	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III
Production and Income												
1. GNP at Market Prices[a]	$ mil.	193,072	198,184	191,492	202,852	207,956	212,308	217,412	210,132[b]	222,400[b]	229,788[b]	235,892[c]
2. Farm Cash Receipts Total[d]	$ mil.	2,503.4	2,361.5	10,035.3	2,660.0	2,222.9	2,624.3	2,664.8	10,171.9	2,904.0	2,705.6[c]	2,954.7[c]
3. – Total Crop[d]	$ mil.	1,141.5	959.4	4,621.7	1,427.0	754.5	1,107.5	1,140.0	4,429.0	1,468.8	1,004.7[c]	1,148.6[c]
4. – Total Livestock Prod.[d]	$ mil.	1,265.9	1,244.3	4,996.3	1,142.7	1,308.6	1,393.4	1,401.1	5,245.8	1,354.6	1,608.6[c]	1,711.2
5. Net Income rec'd by farm operators[a]	$ mil.	3,080.0	2,804.0	3,551.0	2,800.0	3,656.0	2,940.0	2,744.0	3,035.0	3,056.0	4,248.0	NA[e]
Trade												
6. Agricultural Exports	$ mil.	1,015.0	1,035.0	3,960.0	941.0	1,115.0	1,120.0	1,088.9	4,264.9	945.4	1,230.5	1,261.4
7. Agricultural Imports	$ mil.	759.0	836.0	3,129.0	867.0	980.5	827.5	880.9	3,555.8	876.6	1,088.5	943.2
8. Real Domestic Product, Ag[a]	1971=100	107.7	101.5	104.2	95.5	100.6	104.2	104.8	101.3	103.8	102.9	107.2
9. Real Dom. Prod. Less Ag[a]	1971=100	126.4	127.4	125.9	129.3	129.4	130.2	131.1	130.0	132.0	133.1	134.4
Price Indexes												
10. Farm Input Price Index	1971=100	172.9	172.3	172.9	175.6	181.2	181.3	181.7	180.0[c]	187.3	196.7	196.0
11. – Buildings & Fencing	1971=100	172.2	175.8	170.7	177.9	180.8	186.7	190.0	183.9	193.4	199.6	200.6
12. – Machinery & Motor Veh.	1971=100	152.6	157.2	153.1	159.9	163.7	165.0	169.1	166.4	172.6	174.1	176.1
13. – Crop Production	1971=100	206.1	205.0	210.1	207.8	210.6	214.1	214.5	212.5	216.3	221.2	223.6
14. – Animal Production	1971=100	165.2	166.2	165.1	162.0	173.2	169.3	165.2	167.4	178.0	203.7	197.3
15. – Hired Farm Labor	1971=100	193.1	200.7	189.8	203.2	207.0	211.0	213.0	208.6	214.5	217.9	206.8
16. – Interest	1971=100	242.4	242.4	242.4	242.8	242.8	242.8	242.8	242.8	242.8	242.8	251.6
17. Farm Prices of Ag. Prod.[d]	1961=100	220.1	209.9	222.6	213.1	222.1	218.8	216.4	217.6[b]	222.2[bf]	234.6[f]	210.7
Input and Credit												
18. Farm Impl. & Equip. Sales	$ mil.	396.0	256.0	1,134.1	163.7	298.3	379.1	283.4	1,124.5	153.9	372.9	418.8
19. Employment In Agriculture[a]	'000	478.7[b]	496.0[b]	474.0	461.7[b]	464.7[b]	470.3[b]	472.7[b]	468.0	460.3	466.0	481.7
20. Av. Farm Labor Rates[d]	$/hr.	3.36	3.42	3.27	3.49	3.54	3.61	3.66	3.56	3.67	3.73	3.78
21. Av. Hourly Earnings-Manuf.	$/hr.	5.82	5.97	5.76	6.16	6.34	6.44	6.57	6.38	6.69	6.77[c]	6.90[c]
22. F.C.C. – Gross Loan Disburs.	$ mil.	95.7	83.1	443.0	77.8	129.9	175.7	125.4	508.8	78.4	127.8	205.7
23. F.I.L. – Loans Made	$ mil.	44.3	25.3	159.9	24.9	51.6	53.1	34.1[c]	163.7	37.8[c]	NA	NA
24. CPI – All Items	1971=100	140.8	143.7	148.9	155.5	159.1	162.6	166.1	160.8	169.2	173.3	177.7
25. – Food at Home	1971=100	164.5	162.6	164.1	168.0	175.9	182.7	188.6	178.8	194.8	208.3	218.7
26. – Food Away from Home	1971=100	177.7	180.5	176.3	184.1	185.8	188.3	190.0	187.0	192.6	194.9	202.2
27. Industry Selling Price Index – Food & Beverage	1971=100	174.8	173.0	173.7	178.8	187.3	187.9	189.2	185.9	194.9	203.9	209.5
Other Indicators												
28. Unemployment Rate[a]	%	7.2[b]	7.4[b]	7.2[b]	7.9[b]	8.0[b]	8.2	8.4	8.1	8.4	8.6	8.5
29. Exchange Rate	$ U.S.	0.98	.99	0.99	1.03	1.05	1.07	1.10	1.06	1.11	1.13	1.14
30. Av. Rate on New Demand Loans	%	10.6	10.7	10.6	9.1	9.1	8.6	8.7	8.9	8.7	9.7	10.0
31. Quarterly Pop. Est.	mil.	23.03	23.10[b]	22.88[b]	23.16[b]	23.22[b]	23.28[b]	23.34[b]	23.16[b]	23.39[b]	23.44[b]	23.50

[a]Seasonally adjusted at annual rates.
[b]Revised.
[c]Preliminary.
[d]Excludes Newfoundland.
[e]Not available.
[f]Based on current initial prices only for wheat, oats, and barley in Alberta, Saskatchewan, and Manitoba.

NOTES

TERMS OF REFERENCE AND PROCEDURES OF THE NATIONAL FARM PRODUCTS MARKETING COUNCIL

Note to readers: The following is the new set of guidelines for the Council outlined by Agriculture Minister Eugene Whelan.

1. The National Farm Products Marketing Council (NFPMC) in fulfilling its duties must act in such a way that the following are achieved:

(1) for producers –
 (a) more efficient producers have the opportunity to produce more of the regulated product;
 (b) there be uninhibited flow of product across provincial boundaries;
 (c) the sale of product not be limited to certain buyers;
 (d) there be sufficient producers of the regulated product so that competition among producers will not be inhibited.

(2) for processors and distributors –
 Processors and distributors must be able to obtain from Canadian producers sufficient product to supply their customers at all times and at a price which will allow sale after processing at a price sufficient to return a reasonable profit.

(3) to balance the interests of producers and consumers –
 (a) efficient producers should be able to obtain a reasonable return;
 (b) consumers should be able to buy an adequate supply of product at prices that are not more than sufficient to give efficient producers a reasonable return.

In supervising and/or regulating a marketing plan, critical areas for examination by Council are supply and price. In doing this, Council must continually assure itself that:

(a) global quotas of the regulated product are large enough to supplement required imports and supply the demand of consumers and the reasonable demand of processors;

(b) provincial quota restrictions for individuals should be sufficiently uniform that they do not result in significant cost differences between provinces;

(c) provincial quota transfer rules should not result in production cost escalations;

(d) prices to producers should be adequate to provide efficient producers a reasonable return (on average in any one year). Accordingly, great care must be used in formula pricing to use appropriate feed conversion ratios, feed costs, labor costs, depreciation and return on investment. Quota values would not be a reasonable cost factor;

(e) prices to processors should be no more than sufficient to sell in competition with imported products made from the regulated product and make a reasonable profit. Imports considered here are those in excess of the Canadian regulated product quotas set by Canada under GATT Article XI;

(f) while actual prices are not set out here, the formulae for establishing prices must be carefully scrutinized to ensure the maintenance of a Canadian industry. If quotas acquire values, then such values would be a significant indicator of price adequacy or inadequacy.

PUBLICATIONS

Because of heavy demand for the **Agricultural Marketing Handbook** *by S. H. Lane (reviewed in our August Issue), the University of Guelph has found it necessary to charge a fee for this publication. It is now available for $4.55 plus mailing charges from the Campus Co-operative Bookstore, University of Guelph, Guelph, Ontario.*

Canadian Grains Industry Statistical Handbook. 1978. 263p. *Available for $5.00 from the Canada Grains Council, 500 – 177 Lombard Ave., Winnipeg, Manitoba, R3B 0W5.*

Fifteenth Annual Review: A Time for Reason. The Economic Council of Canada. October 1978. 159p. *Available for $4.00 (Canada) or $4.80 (other countries) through your bookseller or Printing and Publishing, Supply and Services Canada, Ottawa, Ontario, K1A 0S9.*

A Study of Profit Margins in the Food Industry. 1978. 135p. *Available free from the Anti-Inflation Board, 12th Floor, 219 Laurier Ave. West, Ottawa, Ontario K1P 6B1.*

The following six publications are available free from Alberta Agriculture, 9718 - 107 St., Edmonton, Alberta, T5K 2C8.

A Consensus of Costs and Returns – 50 Acres of Sweet Corn on a 320-Acre Irrigated Farm in the Taber District, Southern Alberta. A. G. N. Van Deurzen. November 1978.

A Consensus of Costs and Returns – 100 Acres of Corn Silage on a 480-Acre Irrigated Farm in the Taber District, Southern Alberta. A. G. N. Van Deurzen. November 1978. 8p.

A Consensus of Costs and Returns – 50 Acres of Green Field Peas on a 480-Acre Irrigated Farm in the Vauxhall District, Southern Alberta. A. G. N. Van Deurzen. November 1978. 8p.

A Consensus of Costs and Returns – Winter Wheat, Barley, Rapeseed, and Summer Fallow on a 1280-Acre Farm, Spring Coulee District, Southern Alberta. A. G. N. Van Deurzen. November 1978. 12p.

A Consensus of Costs and Returns – 300 Cow-Calf Ranch, Calgary District, South Central Alberta. G. Monner. 1978. 14p.

A Consensus of Costs and Returns – 100 Cow-Calf Enterprise, Calgary District, South Central Alberta. G. Monner. September 1978. 15p.

IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we will try to accommodate you.

When forwarding your "In Reply" or letter, indicate if we may publish your comments in a subsequent issue.

F. Westrik, of the Farm Credit Corporation, Chatham, Ontario, wrote to point out that in the "In Reply" of Canadian Farm Economics, Volume 13, Number 4, "the interest rates charged by the Farm Credit Corporation as provided by A. S. Brunst are all 1% lower than the actual rates during 1970-1976."

Earl Cook, a geography professor at the College of Geosciences, Texas A & M University, College Station, Texas, gave the following comments on Ian Furniss' article, "The Energy Demands of Agriculture," in our June issue: "A major research interest of mine is the relations of food and feed production to other *forms* of energy, including the energy costs of producing food/feed energy. The article is thorough, informative, lucid, and emphasizes management options for the future."

Yasumasa Mita, a professor at the Dairy College, 582 – Nishinopporo, Ebetsu City, Hokkaido, Japan, was pleased to learn about "recent trends and problems in Canada's agricultural trade" from J. S. Lohoar's article in our August issue. He finds CFE a very useful means of obtaining information about Canada's farm economy. Mr. Mita is interested in learning more about the "competition between Canada and the United States in agricultural trade."

Douglas Hoffman, a professor at the School of Urban and Regional Planning, Waterloo University, Waterloo, Ontario, liked G. E. Pugh's article, "Some Observations on the Cattle Cycle in Canada," in our August issue, because "it helped to explain beef fluctuations and presented an additional factor that must be taken into account when attempts at stabilization are made." He would like to see some follow up to the paper, "for example, discussion concerning the value of cooperatives in effecting stabilization of cattle."

Allen R. Kingston, farm manager of Cumberland Farm, P.O. Box 208, Cumberland House, Saskatchewan, also had praise for the Pugh article: "The article summed up what most cattlemen knew, or thought they knew about the 10-year cycle and the whys of ups and downs. The point on heifer sales in the last cycle is well taken. A point missed was the effect of the Yom Kippur War and subsequent escalations of oil prices to countries developing a taste for red meat. The *world* price for meat dropped off and exporting countries like Australia, etc., were really strapped for a place to dump beef. Thank God the U.S. market for Big Macs is insatiable as I believe it kept the Canadian cow market from being a worse disaster than it was." Mr. Kingston pointed out that this is not his original economic thought, but that he heard it from someone else – probably from Dr. "Red" Williams, of the University of Saskatchewan.

Ralph Macartney, a beef cattle specialist with the Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, wrote the following: "The entire issue (August) was most helpful. It dealt with current issues and situations in agriculture in a clear and concise manner. This is the kind of information that I, as an extension person, need on a continuing basis. We need to be brought up to date on Canada's trade position and the GATT negotiations. The cattle cycle is most important. Future issues could deal with other livestock and grain production cycles."

Robert N. Plank, Assistant Regional Manager, Farm Credit Corporation, P.O. Box 249, Kelowna, B.C. also found the August issue very useful. "As the first article indicates (J. S. Lohoar), trade is important to agriculture, and hence to people employed in, or dealing with, agriculture. The author (A. A. Darisse) provided a broad outline of the GATT, without too much detail. I have not found such information elsewhere . . . Article No. 3 (G. E. Pugh) is of direct interest to our business."

IN REPLY TO AUTHORS AND EDITORS REGARDING DECEMBER 1978 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) An Economic Assessment of Zero Tillage in Wheat-Fallow Rotations in Southern Alberta
(2) Margins in the Dairy Processing Industry
(3) Farmers' Participation in Registered Retirement Savings Plans

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

not useful	1	2	3	4	5	6	7	8	9	10	very useful

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr. or Ms.)______________________________Occupation________________
(Please Print)

ADDRESS____

Please return the above to:

Earl Love, Managing Editor, Canadian Farm Economics
Information Services
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
Canada
K1A 0C5

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

VOLUME 14 NUMBER 1–2 FEBRUARY – APRIL 1979

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. EUGENE WHELAN, MINISTER – GAÉTAN LUSSIER, DEPUTY MINISTER

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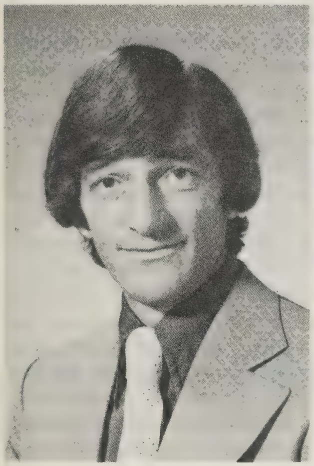
Letters from readers: Letters are encouraged and should be addressed to the editor. Comments and suggestions are useful to editors and authors for effective two-way communication. Edited letters will be used in CFE with the writer's permission.

GOVERNMENT POLICIES FOR THE CANADIAN DAIRY INDUSTRY



D. Peter Stonehouse*

A marked increase in government involvement in the Canadian dairy industry has occurred since the Second World War, particularly since the inception of the Canadian Dairy Commission (CDC) in 1966. Government efforts to exert more influence on domestic milk production, the level of producer returns, and international trade in industrial milk products have led to the adoption of a wide array of policy instruments. A rather complicated dairy policy has resulted, one that is increasingly difficult to understand. The purpose of this paper is to describe the current dairy policy, explain how it has arrived at its present complex state, and outline its basic intentions. The purpose is not to question or justify this policy.

IMPORTANCE OF THE DAIRY INDUSTRY

In 1977, commercial sales of milk and cream accounted for almost 14 percent of Canadian farm cash receipts; with federal government direct subsidy payments included, they comprised nearly 17 percent. Sales of vealer calves and slaughter cattle from the dairy herd represented an estimated 15 to 20 percent of Canada's domestic beef supplies, and accounted for a further 3 percent of total farm cash receipts. The dairy industry as a result is the most important source of farm income after beef. On the demand side, consumer expenditures on milk and dairy products made up almost 16 percent of total food expenditures in 1977, again second only to expenditures on beef. Taking the milk production and processing sectors together, the dairy industry contributed nearly two billion dollars (or approximately 1 percent) to the Canadian gross national product in 1977, and comprised about 97 percent of all Canadian milk requirements.

GOVERNMENT INVOLVEMENT

It is doubtful whether the dairy industry would be such a prominent sector of the Canadian economy without extensive government intervention. Provincial governments, in pursuit of self-sufficiency in and year-round continuity of supplies, seasonal price stability, and adequacy of real returns to producers, are responsible for regulating prices and supplies of milk sold for fluid purposes within their boundaries. The federal government, in cooperation with provincial authorities, is responsible for regulating supplies and gross returns for industrial milk and cream used in the manufacture of butter, cheese, and other processed dairy products. The purpose of federal intervention since 1967 has been to establish an effective supply management program to achieve the following objectives:

1. to ensure that Canadian domestic requirements for processed dairy products are met as much as possible from Canadian sources of milk, and at the same time, avoid accumulations of large stocks of surplus processed products;

2. to procure price stability for efficient Canadian industrial milk producers and a level of real returns that includes reasonable compensation for management, labor, and capital invested; and

3. to provide Canadian consumers with adequate and continuous year-round supplies of high quality pro-

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cessed dairy products at stable and reasonable real price levels.

The object of effective supply management in the Canadian dairy industry is to make continual supply adjustments to obtain a reasonable supply-demand balance, and at a price predetermined by government to give a fair return to producers. The supply adjustment process has been complicated by the following domestic and international market trends in the 1970s:

1. Persistent declines in domestic requirements for milk and dairy products as a group, despite expanding demand for some individual products, reflected changes in consumer tastes and preferences, and negative consumer reaction to retail price increases.

2. Growing international surpluses of processed dairy products caused world prices to fall and the disparity between rising Canadian (government-supported) prices and falling world prices to widen. Consequently, Canadian export market opportunities decreased.

3. Weather-related variations in pasture conditions plus fluctuating returns in beef and cash-cropping alternatives to milk production returns in Canada, led to alternating periods of excess and deficit milk supplies.

Policy-makers have reacted by periodically prescribing additional counter-measures to fine-tune the adjustments necessary to attain an approximate supply-demand balance. With each new policy measure a further complicating factor is introduced, making it increasingly difficult to understand Canadian dairy policy and the government's important role in the dairy industry.

AN OVERVIEW OF GOVERNMENT DAIRY POLICIES

Canadian dairy policy affects all sectors of the dairy industry from farm production of milk to international trade in processed dairy products. Table 1 provides a summary of the principal policy instruments that have been or are still in effect, the sectors affected, the periods in effect, the purposes of the policy instruments, and the levels of government responsible for each instrument.

The primary goal of practically all of these policy instruments, whether under federal or provincial jurisdiction, has been to encourage long-term viability in the domestic dairy industry, so that domestic consumption of dairy products may continue to be met predominantly by Canadian production. The most appropriate avenues for promoting a viable dairy industry were perceived to be stable farm prices, with consequent reduction in risk, and a sufficient level of returns to encourage efficient-sized enterprises and the adoption of cost-saving technology. Discriminatory pricing and import tariff and non-tariff barriers are obvious examples of price stabilizing and price increasing measures. Less obvious are the offers to purchase processed products at minimum guaranteed prices. These measures were designed to allow processing plants to pass on some of the benefits of higher and more stable prices to milk producers. Direct subsidies to producers and subsidized exports of surplus processed products represent further measures to increase producer returns.

Subsidies at the same time represent costs to the taxpayer, while current support prices imply higher costs to the consumer. Hence, considerations of gains in producer welfare have been tempered by considerations of offsetting losses in consumer and taxpayer welfare. One consequence of government's desire to balance producer, consumer, and taxpayer interests is the supplanting of open-ended support systems with some sort of limited support program. For the dairy industry, the support program is limited first by issuing quotas on total milk shipments, second by establishing the maximum percentage of total quota shipments eligible for direct subsidy payments, third by deducting from producers' market returns "in-quota holdbacks" used to help finance export disposal of products surplus to domestic requirements, and fourth by exacting penalties on all shipments exceeding quota limits.

Besides providing the tools for limiting the extent of overall producer support, government uses quotas, penalties, and holdbacks to manage supplies. Relaxing quota restrictions and lowering penalty and holdback disincentives encourages milk supply expansion (and vice versa).

The sequence of decisions to be made for an effective supply management program is as follows:

1. Some combination of support prices and direct subsidy levels must be selected to yield a unit producer target return that the government considers satisfactory to maintain a viable dairy industry.

2. Total domestic market requirements for milk must be estimated in relation to the support price levels determined in step 1.

TABLE 1. PRINCIPAL CANADIAN DAIRY POLICY INSTRUMENTS

Dairy Sector	Policy Instrument	Period in Effect	Purpose of Policy	Government Level
Fluid Milk Production	Shipment Quotas	1965[a] –	Control Milk Supply	Provincial
	Discriminatory Pricing	1965[a] –	Income Support-Stabilization	Provincial
Industrial	Shipment Quotas	1967 –	Control Milk Supply	Federal-Provincial
Milk and Cream Production	Over-Quota Penalties	1969 –	Control Milk Supply	Federal-Provincial
	Direct Subsidies	1962 –	Income Support	Federal
	Discriminatory Pricing	1966[a] –	Income Support-Stabilization	Provincial
	In-Quota Holdback	1967 –	Export Disposal of Surplus	Federal-Provincial
Processing of Industrial Milk Products	Offers to Purchase with Guaranteed Minimum Prices	1946 –	Wholesale Price Support for Selected Processed Products	Federal
Domestic Retail Demand	Consumer Subsidies			
	for – Butter	1962 – 1966	Retail Price Reduction	Federal
	– Fluid Milk	1973 – 1975	or Moderation of	Federal
	– Skim Milk Powder	1973 – 1978	Retail Price Increases	Federal
International Trade	Import Tariffs	1906 –	Domestic Market	Federal
	Import Embargos	1951 –	(Price and Quantity)	Federal
	Import Quotas	1975 –	Protection	Federal
	Export Subsidies	1964 –	Export Disposal of Surplus	Federal

[a]Ontario; – for Quebec, these policy instruments were introduced in 1971.

TABLE 2. INDUSTRIAL MILK TARGET RETURNS ADJUSTMENT FORMULA

Component	Consumer Price Index (Imputed Labor Earnings)	Dairy Cash Input Price Index	Judgment Factors
Index Base	1971 = 100	1970-1972 = 100	—
Weight (Percentage)	35	45	20
Subcomponents (Dairy Cash Input Price Index)	Dairy Ration, 16%	13.4	
	Hired Labor	6.6	
	Other Materials and Services	7.8	
	Artificial Insemination	0.6	
	Machinery Repairs	3.1	
	Petroleum Products	2.0	
	Custom Work	0.4	
	Fertilizer	3.1	
	Seed	1.9	
	Building Repairs	1.4	
	Property Taxes	2.8	
	Electricity	1.9	
	Total	45.0	

Indicated Target Return = Base Target Returns Level[a] + Cumulative Change Due to Returns Adjustment Formula

Cumulative Formula Change = (Change in Cash Inputs × Weight × Base Target Return) + (Change in CPI × Weight × Base Target Return)

[a]Base Target Returns Level = $25.05 per hL of milk on April 1, 1975.

3. Some combination of quota levels, penalties, and holdbacks must be selected to induce approximately sufficient supplies to meet domestic requirements estimated in step 2.
4. The aggregate quota level limiting supplies must be allocated among provinces and, within each province, among individual producers.
5. Any significant deviation between actual volumes of milk demanded and supplied must be rectified by resetting supply management instruments to adjust supplies or by manipulating international trade instruments (either to dispose of surpluses or to permit imports) or both.

INCOME SUPPORT AND STABILIZATION POLICIES

Target Returns on Industrial Milk

The history of price supports and direct producer subsidies in the Canadian dairy industry has been well documented by McCormick (5 and 4). Each provincial government is responsible for setting producer prices for fluid milk marketed within its boundaries. Most provinces use some method of indexing prices to cost of production and other factors to ensure that producer returns are attractive enough to maintain adequate supplies for meeting provincial demand. Although industrial milk pricing is also basically under provincial jurisdiction, there has been a history of federal government assistance, starting in the depression of the 1930s with bonuses and quality premiums for cheese.[1] To these were added direct producer subsidies in the 1960s to help close the gap between fluid and industrial milk returns and to encourage domestic industrial milk production. Support prices and direct subsidies are the twin federal policy instruments used to establish "target returns"[2] to industrial milk producers.

Returns Adjustment Formula

A period of rapidly rising milk production costs during the early 1970s instigated new federal measures to maintain real levels of target returns through a "returns adjustment formula." The formula components are a dairy cash input price index with a composite weight of 0.45; the Consumer Price Index (CPI), used as a proxy for the labor earnings of dairy farm operators plus unpaid family labor, with a weight of 0.35; and judgment factors, with a weight of 0.20 (Table 2). The formula calculates the changes in cash inputs and CPI components for each three-month period. These weighted components are then multiplied by the target returns for the base period, $25.05 per hL of milk on April 1, 1975. If the indicated change in target returns for the current period differs at least 4 percent from the previous three-month periods' target returns, then a new target return can be established. However, such indicated changes in target returns due to cash inputs and proxy labor earnings are not implemented automatically. The judgment factors component can be called upon to modify the indicated change in either direction. This component is related to the federal government's assessment of the current domestic and international dairy market situation. For example, if the domestic market has an excess supply, as indicated by current inventories of processed dairy products, or if international dairy product price declines are anticipated, then judgment factors could be implemented to ensure some downward modification of the indicated target returns change of up to 20 percent. Whether or not the judgment factors component is implemented, two important points about the operation of the returns adjustment formula require emphasis. The first is that no change in target returns may take place unless the indicated change due to cash inputs and proxy labor earnings is calculated to be 4 percent or more. The second is that any change in target returns must not occur more than once in each quarter.

Subsidy Rate Changes Versus Support Price Changes

Having decided on a particular target return level, the federal government must then select some combination of direct subsidy and processed product support price levels to achieve this target return (Figure 1). In effect, the government must decide how to distribute the burden of increased producer target returns between taxpayers (through increased direct subsidies) and consumers (through increased retail prices reflecting higher support prices). In addition, if support prices are raised, there is no guarantee that processing plants will pass on all the benefits to milk producers; hence the term "estimated producer market return" is used in Figure 1. To increase the likelihood of producers receiving the benefits of higher support prices, the government returns-setting mechanism allows for a "reasonable" processing plant margin ("assumed processing plant margin" in Figure 1). This margin is reviewed and adjusted as the need is perceived.

An additional consideration in placing the burden of increased producer target returns on increased support

[1] Legislation enabling price supports to be applied to creamery butter and cheddar cheese was passed in 1944 (McCormick, 5, p. 57). In 1966, price supports were introduced for skim milk powder. Since 1970, price supports for cheddar cheese have been inoperative, because average wholesale prices have been exceeding support prices; support prices continue to be operative for butter and skim milk powder.

[2] The term "target returns" signifies desired but not necessarily attained returns; support price changes at the processing plant level are not necessarily translated into equivalent producer price changes at the farm level.

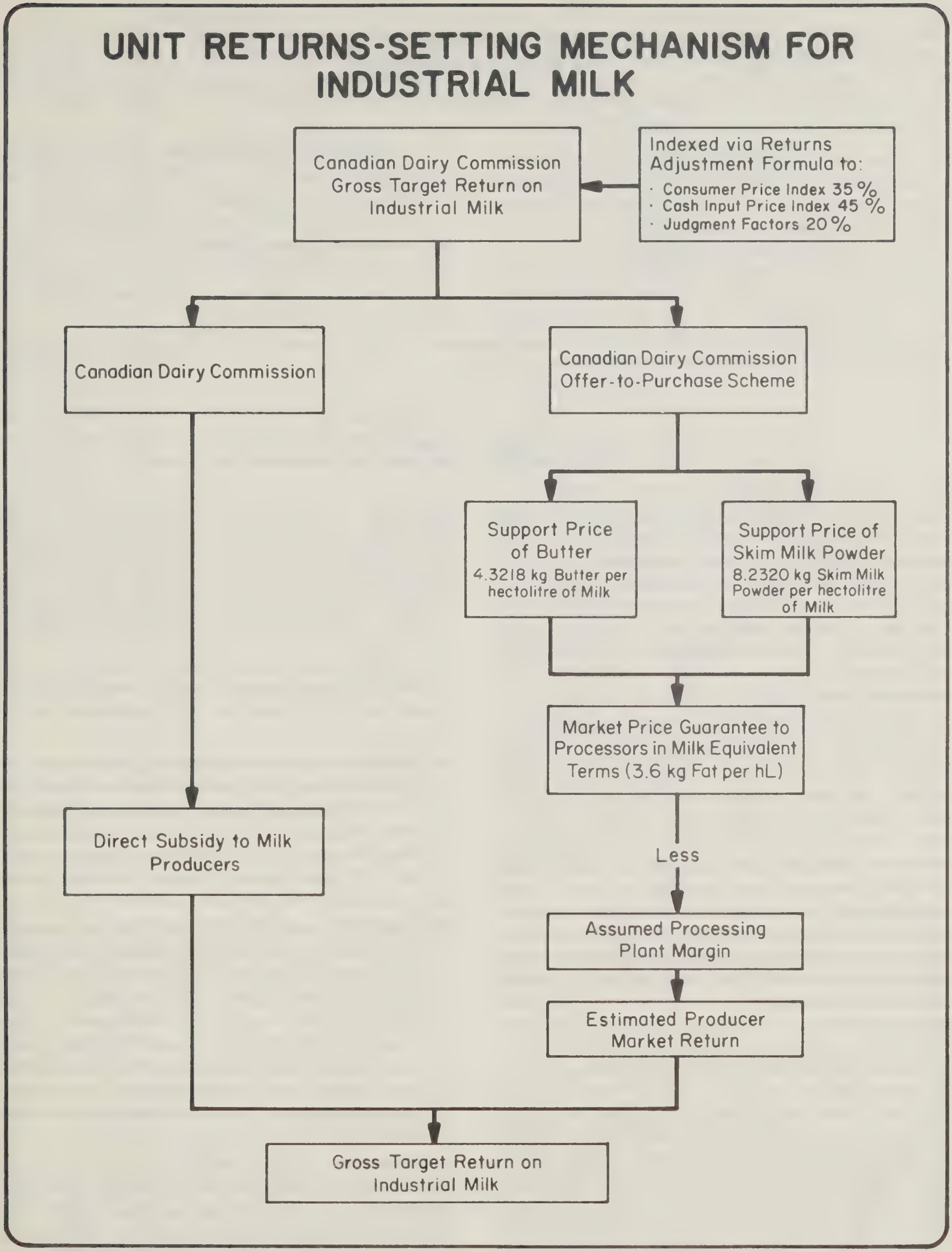

UNIT RETURNS-SETTING MECHANISM FOR INDUSTRIAL MILK
Canadian Dairy Commission Gross Target Return on Industrial Milk
Indexed via Returns Adjustment Formula to:
· Consumer Price Index 35 %
· Cash Input Price Index 45 %
· Judgment Factors 20 %
Canadian Dairy Commission
Canadian Dairy Commission Offer-to-Purchase Scheme
Support Price of Butter
4.3218 kg Butter per hectolitre of Milk
Support Price of Skim Milk Powder
8.2320 kg Skim Milk Powder per hectolitre of Milk
Market Price Guarantee to Processors in Milk Equivalent Terms (3.6 kg Fat per hL)
Less
Assumed Processing Plant Margin
Estimated Producer Market Return
Direct Subsidy to Milk Producers
Gross Target Return on Industrial Milk

Figure 1

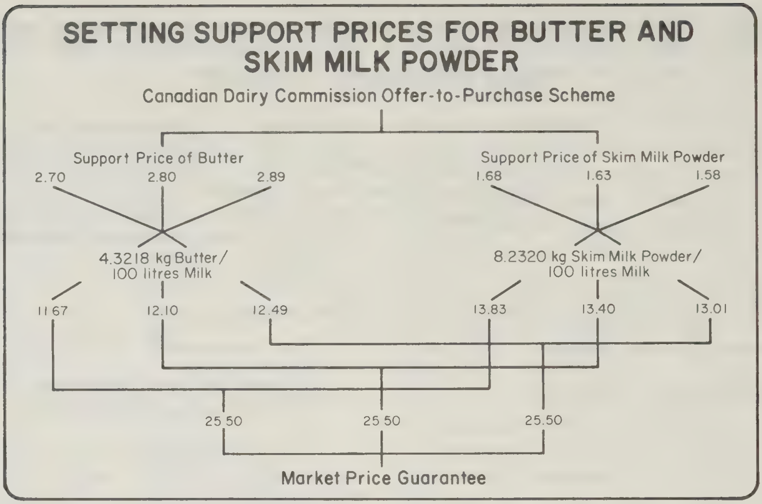


Figure 2

prices is that taxpayers might suffer an indirect loss in welfare. Higher support prices may generate increased surpluses to be disposed of in export markets at a loss, and if insufficient funds are furnished by producer in-quota holdback to cover these losses, then the burden could be transferred to the taxpayers. (In-quota holdback rates are typically adjusted at the beginning of each dairy year, although interim adjustments have been made in the past.)

A further provision of the returns-setting mechanism is that since the returns adjustment formula became effective April 1, 1975, direct subsidy rates have been adjusted only once annually at the beginning of each dairy year.[3] Thus, the government is faced with the difficult three-way choice of weighing the welfare of producers, consumers, and taxpayers only once a year. For the balance of the dairy year, formula-induced adjustments to returns must be met from changing support prices alone, so that the government need only weight producers' welfare (the desirability of raising target returns) against consumers' welfare (the desirability of holding down retail prices, and therefore support prices).

Distributing the Support Price Load Between Butter and Skim Milk Powder

With each determined change for support prices, the government must decide how to distribute the change between butter and skim milk powder prices. Many price combinations for these joint products are possible for achieving some pre-determined market price guarantee. (Some example combinations are illustrated in Figure 2.) The coefficients of 4.3218 for butter and 8.2320 for skim milk powder are the generally accepted standard amounts that can be derived from 100 litres of milk containing 3.6 kg of butterfat. By multiplying these standard conversion coefficients by appropriate product prices, the desired market price guarantee will be obtained.

In selecting some particular price combination, the Canadian Dairy Commission (CDC) considers the following market factors:

1. Butter is considered the more important of the two products since attempts are made to balance domestic demand and supply of milk on a butter-fat basis; therefore, it is crucial not to increase butter prices too much or too fast because of the depressing effect on domestic demand and consequent reduction in milk shipments required.
2. Skim milk powder surplus to domestic requirements is exported, usually at a loss, because world prices are typically lower than domestic support prices, and these losses must be funded either by milk producers (See Section C, International Trade Policies.) or by taxpayers. Thus, skim milk powder prices should not be allowed to rise much above world price levels, in the interests of containing the producers' or taxpayers' burden within manageable limits.

The CDC must therefore balance the desire to maintain the size of the dairy industry (through moderating butter price increases) with the need to minimize fund requirements for exporting surplus skim milk powder (through moderating powder price increases). At the

[3]The dairy year begins April 1 and ends March 31.

same time, the Commission must ensure a high enough level of the combination of prices to reach the market price guarantee implied by the given target return and direct subsidy levels.

SUPPLY MANAGEMENT POLICIES

The history of institutional arrangements for supply management in the Canadian dairy industry until 1973 has been well documented by McCormick (6) and Mestern (7). The principal elements of these arrangements are reviewed here, before an explanation of more recent developments.

Supply Control Through Subsidy Eligibility Quotas

Prior to the CDC's establishment in 1966, subsidies and price supports in effect were applied to all domestically-produced butter and cheddar cheese without limit. In effect, an open-ended support scheme existed. With the introduction of more generous subsidies and support prices in 1967, it was felt necessary to limit total treasury assistance, and to attempt to equate total milk supplies with the volume required for domestic and commercially-viable export markets. It was also thought necessary to inaugurate some method of shared access to federal subsidies for all efficient industrial milk producers. Both these goals were achieved through the creation of subsidy eligibility quotas (SEQ), which provided each industrial milk producer with a share of total federal subsidies.

As pointed out by McCormick (6), the problem with SEQ was that the federal government had no control over industrial fluid milk,[4] yet was responsible for supporting prices of processed dairy products, export disposal of surplus products, and levy collection from milk producers to finance export disposal of surpluses. Levies, however, could only be collected from industrial milk producers and not from fluid producers contributing their surplus milk to the processed dairy product market. In addition, it was difficult to balance supplies and demands for industrial milk in the absence of effective control over industrial fluid milk supplies.

The Comprehensive Plan and Market Sharing Quotas

A solution to the SEQ problem was sought by formulating a "comprehensive milk marketing plan" and issuing market sharing quotas (MSQ) which covered shipments of both industrial milk and industrial fluid milk. The MSQ system set out to achieve control over total industrial milk shipments from all sources, to maintain an approximate balance between supply and demand, and to provide each industrial milk producer with some guaranteed share of the market. Originally, only Quebec and Ontario were participants in the plan, but by April 1974 all provinces had become signatories.

[4]Industrial fluid milk is fluid milk shipped in excess of fluid milk requirements, and transferred to the industrial milk pool for processing into butter, cheese, and other processed products.

In April 1975, the "Canadian Milk Supply Management Committee" (CMSMC) was created. It is composed of delegates from each province's milk marketing board or commission, the Dairy Farmers of Canada and the CDC, which chairs the bimonthly meetings. The CMSMC's mandate is to estimate domestic and export requirements for industrial milk, to recommend for the federal cabinet's approval the total amount of MSQ to be issued, the amount to be made eligible for direct subsidy, and to decide how the total MSQ is to be allocated among the provinces.[5]

Policy Instruments for Effective Supply Management

The objective of effective supply management in the dairy industry is to continuously adjust supplies of industrial milk to meet domestic and commercial export market requirements for industrial milk at a market price that provides producers with a reasonable return. This market price is predetermined and controlled by policy instruments on the supply side. Retail demand prices, though not directly controlled, are strongly influenced by these policy instruments. Consumers respond to these policy-influenced retail prices by altering the amounts of dairy products purchased. Hence, to maintain an approximate balance in supply and demand, supplies must be continuously adjusted in accordance with demand.

Total MSQ Issued and Over-Quota Penalties

The principal policy instrument used to achieve the necessary adjustment in supplies is the aggregate amount of MSQ issued to producers. Since MSQ are effectively licences to ship industrial milk, they embody implicit upper limits to physical shipments to which each producer is entitled. To ensure stricter adherence to these upper limits, penalties are put on all shipments exceeding an individual producer's entitlement. The penalty for the 1978-79 dairy year is $17.03 per hL of milk.

Besides deterring over-production, penalties provide some of the revenues for disposing surplus dairy products in export markets, where prices are lower than in the domestic market under the offer-to-purchase scheme. In setting over-quota penalty rates, the CDC

[5]The provinces are responsible for distributing their share of MSQ among the individual industrial milk producers.

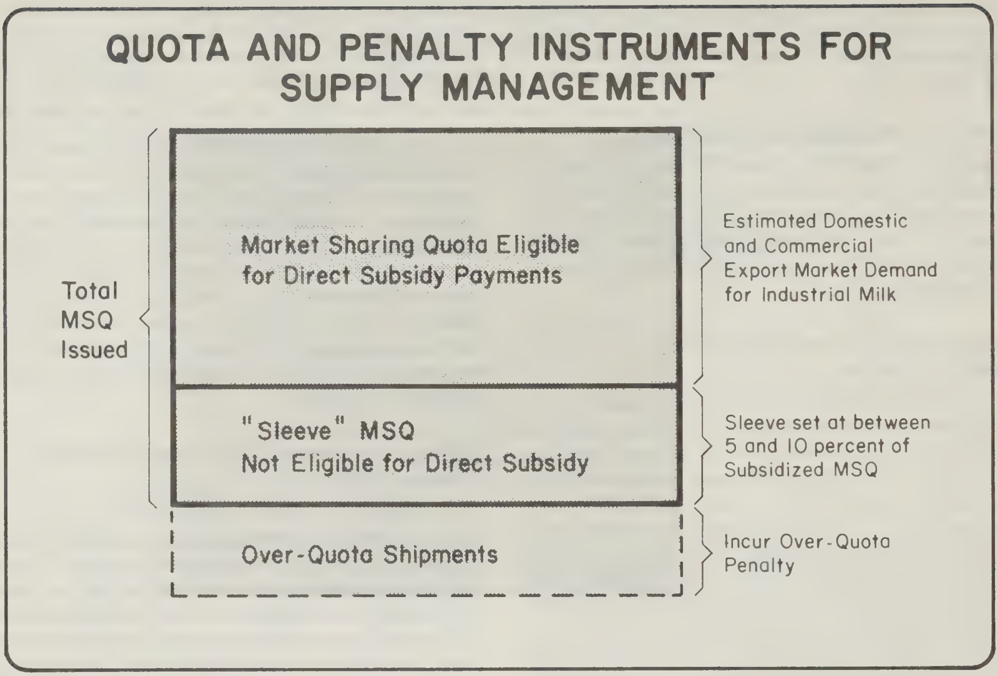


Figure 3

therefore takes into account the trading losses implicit by the difference between domestic support and world prices.

Subsidized MSQ and the Sleeve

While total MSQ issued is related closely to domestic and commercial export requirements, there is no one-to-one correspondence between the two. As shown in Figure 3, it is the MSQ eligible to receive direct subsidy payments that is directly related to estimated requirements. The national MSQ for industrial milk and cream currently consists of market requirements, special allotments for some minor producing provinces, and a 5-to-10-percent tolerance or sleeve. Subsidies are not paid on the sleeve, the purpose of which is to provide sufficient flexibility in the quota system to ensure that adequate milk supplies are forthcoming to meet requirements. For individual producers who fill their subsidized MSQ, the sleeve at the same time lessens the risk of incurring over-quota penalties.

Levy Funds for Export Disposal of Surplus Skim Milk Powder

Industrial milk supplies and demands are balanced on a butterfat, not on a whole milk basis. Since total Canadian demand for butterfat is higher than that for solids-not-fat (SNF), the surplus SNF in the form of skim milk powder must be disposed of in export markets. The difference between domestic support prices and world prices for skim milk powder necessitates subsidizing exports of surpluses.

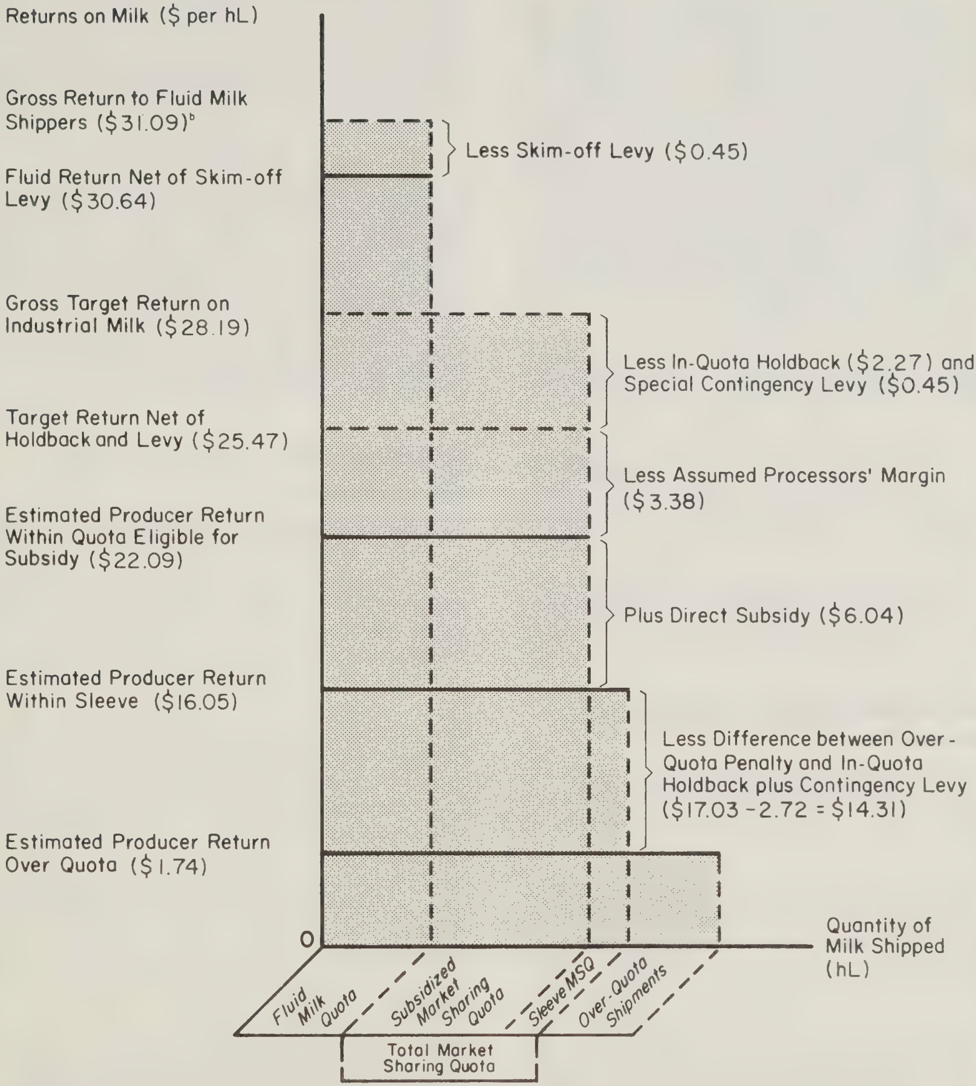
While the federal government assists with the export disposal of surplus skim milk powder, the onus to generate the necessary funds is placed mainly on milk producers. These funds are procured through a complicated system of holdbacks from direct subsidy payments and special levies.

Industrial milk shippers, including those of industrial fluid milk, have paid levies in the form of holdbacks from their market returns since 1967. These holdbacks apply to all milk shipped within the MSQ, including the sleeve. Farm-separated cream shippers are presently not liable for these holdbacks since it is thought that they do not contribute to surplus skim milk powder problems. The holdback for the 1978-79 dairy year is \$2.27 per hL of milk.

Since April 1977, fluid milk shippers have been subject to a special levy (of \$2.27 per hL in the 1978-79 dairy

IMPACT OF DAIRY POLICIES ON MILK PRODUCERS' RETURNS

(April 1, 1978 Values[a] Used as an Illustration)



[a] Source: Dairy Farmers of Canada, Dairy Facts and Figures, 1978, Ottawa, 1978.

[b] National average minimum price paid to fluid producers, f.o.b. processing plant.— Source: Agriculture Canada, Dairy Produce Market Report, Vol. 53, No. 11, Ottawa, April 1978.

Figure 4

year) on the surplus cream, in milk equivalent terms, diverted from the fluid sector for industrial uses.[6] Although fluid shippers contribute nothing to the surplus skim milk powder problem, levies were considered justified since the fluid milk industry benefits indirectly from the federal industrial milk support program.[7]

In April 1978, a special "contingency levy" fund was introduced to fund export disposal of surplus skim milk powder from industrial milk shipped in the sleeve, and to ensure that those responsible for contributing to the surplus problem pay a commensurate share of disposal costs. Although universally applicable (at the rate of $0.45 per hL of milk) on all industrial milk shipments within quota, the levies are refundable at the end of the dairy year, with interest, to all producers not shipping into the sleeve. Those shipping milk into the sleeve are entitled to a proportionate refund depending on the extent to which any sleeve milk is required for domestic and commercial export markets.

The various levy arrangements not only generate funds for export disposal of surpluses, but also deter producers from exceeding commercial market requirements. The size of each levy indicates to milk producers the difference between domestic support and world prices, and therefore the extent to which export losses, largely from producers' pockets, have to be covered.

The federal government does provide assistance to producers if levy funds are insufficient to cover all export losses. For the 1978-79 dairy year, federal budgetary provisions amounted to 24.8 million dollars.

Impact of Dairy Policies on Milk Producers' Returns

The principal effects of the various supply management, income support, and export disposal policy instruments on unit returns to milk producers are illustrated in Figure 4.

The highest possible unit return is for shipments of fluid milk within the fluid quota, based on estimates of provincial fluid milk requirements. Fluid producers, however, receive a return net of skim-off levy deductions.

[6]Surplus (or skim-off) cream emanates from processing whole fluid milk (with an average of 3.65-percent butterfat) into standard milk (3.25-percent butterfat), partially skimmed milk (2.0-percent butterfat), and skimmed milk (0.1-percent butterfat). The levy of $2.27 per hL on the milk equivalent of skim-off cream is equivalent to $0.45 per hL on all fluid milk shipments.

[7]For example, all fluid milk surplus to fluid market requirements is assured an alternative industrial milk market at subsidized prices.

The next highest return is for industrial milk, including industrial fluid shipments surplus to fluid requirements, within the MSQ and eligible for direct subsidy. Gross target returns must be reduced to a net target returns basis by deducting in-quota holdback and, since the 1978-79 dairy year, the special contingency levy. Since some portion of the contingency levy may be refundable, the actual net target return might be somewhat higher than the level entitled "Target Return Net of Holdback and Levy." The assumed processors' margin is then deducted from the net target returns to give the estimated return to industrial milk producers for shipments within quota and eligible for subsidy.

Industrial milk shipped within the sleeve is not eligible for subsidy, but is liable for in-quota holdback and contingency levy deductions. Again, somewhat higher in-sleeve returns are possible depending on refunds of contingency levies. Finally, the lowest return possible is for milk shipped in excess of an individual producer's MSQ entitlement. This return is subject to over-quota penalty, but is not at the same time liable for either in-quota holdback or contingency levy.

INTERNATIONAL TRADE POLICIES

Import Barriers

No supply management and income support program can remain effective for long in an economy open to foreign competition. Barriers to imported dairy products have therefore been a necessary feature of dairy policy, and have become increasingly restrictive as domestic support levels have increased.

Import tariffs have been levied since 1906, and are now applicable to all dairy products except butter, imports of which the CDC has exclusive responsibility. Tariff arrangements have been reinforced since 1951 by quantitative import controls, which require permits to be issued by the Department of Industry, Trade and Commerce before importing any products on the Import Controls List. All dairy products, except casein for industrial uses, are currently on the list. One example of permits issued in the 1978-79 dairy year is the 20411.87-tonne quota on natural and processed cheese imports.

Export Assistance for Surplus Products

Apart from the provisional[8] financial assistance for covering export losses of surplus dairy products, direct

[8]Producer levy and in-quota holdback revenues are used first by the CDC to finance export disposal, but if these funds are insufficient to cover all losses, the CDC can request financial assistance from Treasury Board.

federal export subsidies have occasionally been applied. For example, in April 1977, the federal government undertook to write off 159 million dollars of accumulated debt in the Export Equalization Account, the fund administered by the CDC for collecting producer levies and holdbacks and paying for export losses on surplus dairy products. Another example is the use of export subsidies on cheddar cheese to the United Kingdom in the 1977-78 dairy year. In addition, assistance is provided on a regular basis by federally-funded purchases of surplus products for food aid programs.

Butterfat Exchange Program

In April 1977, the CDC initiated a new program to reduce producers' losses on exports of surplus skim milk powder. The program's objective is to export some portion of Canadian butterfat requirements in the form of whole milk dairy products (e.g., whole milk powder and evaporated milk) in exchange for importing the equivalent amount of butterfat in the form of creamery butter. This butterfat exchange program was thought to be beneficial to Canadian milk producers because of the following:

1. Export losses on evaporated milk and whole milk powder were lower than those on skim milk powder, thereby reducing demands on the Export Equalization Account.

2. Butter could be imported at the lower world price and then resold in the domestic market at the higher support price, with the proceeds being credited by the CDC to the Export Equalization Account.

The CDC has sole responsibility for all exports and imports under the butterfat exchange program, and its policy is to continue operating the program as long as a positive contribution is being made to the Export Equalization Account.

FUTURE DIRECTION OF CANADIAN DAIRY POLICY

Several elements of the dairy policy are either under review or slated for change. For example, the period for which MSQ is issued and controlled is to be changed from a dairy year basis (April 1 to March 31) to an August 1-July 31 basis starting this year. This should help correct the present seasonal imbalance in industrial milk shipments (the ratio of summer-to-winter shipments is 70 to 30) by issuing quota for the new MSQ year at the beginning of the short winter period. It is hoped that this will encourage more producers to use a greater portion of their annual quota during the winter, and reduce shipments the following summer as they approach their MSQ limits.

As an added incentive to switch from summer to winter milk shipments, the CMSMC is considering the use of differential (seasonal) direct subsidy payments. If industrial milk can be shipped on an even, year-round basis, concomitantly with the pattern of demand for dairy products, then many cost savings would be possible. The number of dairy processing plants, presently built to peak summer milk shipments capacity, could be reduced and the remaining ones could operate more efficiently. CDC storage costs and interest charges for products purchased in the summer for consumption the following winter would be lowered, thereby decreasing taxpayer contributions to the industry.

Finally, the CDC plans to integrate fluid and industrial milk shippers into a single pool marketing system by 1980.

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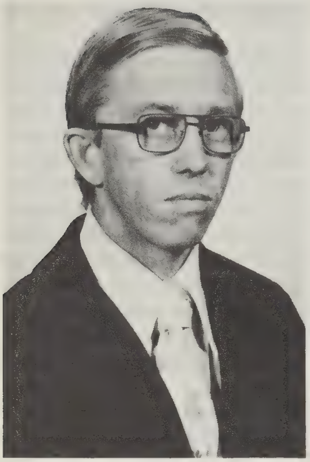
SOME ALTERNATIVES TO CONVENTIONAL FARM MORTGAGE LOAN REPAYMENT PLANS



W. F. Lee*

Most farm mortgage loans in Canada carry a fixed interest rate and call for a fixed level payment that amortizes the loan over a specified term. This type of loan is not ideal in all situations. This paper suggests four alternatives: flexible repayment mortgages, graduated mortgages, variable interest rate mortgages, and reverse mortgages.

INTRODUCTION

The typical farm mortgage loan contract offered by the Farm Credit Corporation (FCC) as well as most private lenders and provincial government agencies in Canada is the familiar level or fixed payment plan. Under these contracts, the loan is repaid in a series of equal annual, semi-annual, quarterly, or monthly payments that repay the loan, with interest, over the repayment period specified in the mortgage. Unlike residential mortgages, most farm mortgages also carry a fixed interest rate for the entire term of the loan.

The level payment mortgage has served its purpose well since it was originated during the depression of the 1930s. Borrowers know exactly how much must be paid on each payment due date and the lenders have a stable and predictable inflow of payments. Moreover, in inflationary times, the borrower's income and the value of the property that secures the loan may be rising. Thus, successive payments are more easily met and the borrower's equity steadily increases, giving borrowers a comforting sense of progress and lenders a safer security margin as the loan is repaid. Level payment mortgages are easily administered and well understood by both borrowers and lenders.

Despite its widespread success and acceptance, the level payment, fixed interest rate loan is not always ideal. This paper discusses four alternatives. *Flexible repayment mortgages* are suggested for borrowers whose incomes fluctuate widely from year to year. *Graduated mortgages* are offered as a partial remedy for the cash-flow problems that young, beginning farmers typically experience. *Variable interest rate mortgages* are designed to eliminate the risk of getting "locked in" to unusually low or unusually high interest rates over a long term. *Reverse mortgages* are suggested as one method of permitting retired farmers to use their equity to supplement retirement income without selling the farm. A $10,000 loan amortized over 20 years at 10 percent per annum compound interest on the unpaid balance is used throughout this paper to illustrate the alternative plans.

FLEXIBLE PAYMENT MORTGAGES

One problem with the conventional level payment plan is the fact that all payments *are* equal. Borrowers whose repayment ability is jeopardized by low yields or prices or large, unanticipated personal expenses sometimes have little choice but to go into arrears. Failure on the borrower's part to fully meet an installment, on or before the scheduled due date, generally involves some investigation by the lender. In cases where valid reasons for default exist, the account is usually carried in arrears for a reasonable time until the borrower can restore it to good standing. This procedure usually

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TABLE 1. TWENTY-YEAR AMORTIZATION SCHEDULE FOR A $10,000, 10-PERCENT LOAN, LEVEL PAYMENT PLAN

Year	Balance Before Payment	Total Payment	Interest	Principal	Balance After Payment
			dollars		
0	–	–	–	–	10,000.00
1	11,000.00	1,174.60	1,000.00	174.60	9,825.40
2	10,807.85	1,174.60	982.54	192.06	9,633.35
3	10,596.69	1,174.60	963.33	211.26	9,422.09
4	10,364.30	1,174.60	942.21	232.39	9,189.70
5	10,108.67	1,174.60	918.97	255.63	8,934.07
6	9,827.48	1,174.60	893.41	281.19	8,652.88
7	9,518.18	1,174.60	865.29	309.31	8,343.58
8	9,177.94	1,174.60	834.36	340.24	8,003.34
9	8,803.67	1,174.60	800.33	374.26	7,629.07
10	8,391.99	1,174.60	762.91	411.69	7,217.39
11	7,939.19	1,174.60	721.74	452.86	6,764.53
12	7,440.98	1,174.60	676.45	498.14	6,266.38
13	6,893.03	1,174.60	626.64	547.96	5,718.43
14	6,290.27	1,174.60	571.84	602.75	5,115.67
15	5,627.24	1,174.60	511.57	663.03	4,452.64
16	4,897.91	1,174.60	445.26	729.33	3,723.31
17	4,095.65	1,174.60	372.33	802.27	2,921.05
18	3,213.16	1,174.60	292.10	882.49	2,038.56
19	2,242.41	1,174.60	203.86	970.74	1,067.81
20	1,174.59	1,174.59[a]	106.78	1,067.81	–

[a]Final payment is adjusted to correct for minor rounding error.

works satisfactorily for lender and borrower; however, it might tend to be arbitrary and the borrower is never certain how long or to what extent he will be carried. Moreover, an extension of the due date may help little because it reduces the borrower's ability to meet the next scheduled installment on time. Obviously, failure to meet loan installments in full, on or before the due dates, is something that both borrowers and lenders should avoid. For lenders, arrears cases increase loan administration costs. Defaulting borrowers incur added costs, financial embarrassment, a weaker credit rating, and the increased possibility of foreclosure. Although most mortgage contracts allow borrowers to pay more than the scheduled installment in good years, thereby building reserves that can be drawn against in poor ones, prepayments generally tend only to reduce the term of the loan, leaving all subsequent installments unchanged. Also, some private lenders charge prepayment penalties to discourage early payments.

A flexible mortgage repayment plan would permit a borrower to increase or reduce the amount of the loan payment, within predefined limits, in response to changes in repayment ability. Many variations are possible but only a few are discussed here.

Table 1 illustrates the process by which a $10,000, 10-percent loan would be amortized over 20 years under the level payment amortization plan, assuming that all annual payments of $1,174.60 are made exactly as scheduled.[1] A flexible mortgage repayment plan would allow for changes in the amortization period, the scheduled unpaid balance, and the interest rate.

A provision for allowing the scheduled balance and amortization period to vary would permit the borrower to reborrow against accumulated equity in low income periods, and make repayments in good years. This privilege would be equivalent to moving backward or forward on the fixed payment amortization schedule such as the one in Table 1. Suppose that a borrower has made the first four payments of $1,174.60 exactly as scheduled but because of low income, cannot meet the full amount of the fifth installment. The scheduled balance after the fifth payment is $8,934.07. The borrower could reduce the payment to $918.97 by moving back to year four, to $686.58 by moving back to year three, etc. If the borrower moved all the way back to the beginning of the schedule, the accumulated equity, $1,065.93, would only be $108.67 short of covering the entire payment in year five. However, if the borrower used the entire equity reserve to meet the fifth payment, he would be starting all over again. Thus, the total amortization period would be extended from 20 to 25 years. Alternatively, the borrower may be able to pay more than $1,174.60 when the fifth payment is

[1]Readers not familiar with the mechanics of loan repayment plans are referred to Nelson, Aaron G., Lee, Warren F., and Murray, William G., *Agricultural Finance, 6th ed.*, Ames, Iowa State University Press, 1973, Chapter 11.

due. A prepayment of $281.19 would move the schedule ahead to the sixth year, a $590.49 prepayment to the seventh year, etc.

Most lenders would justifiably react unfavorably to the prospect of allowing borrowers to deviate this much from the original amortization schedule. This problem could be largely resolved by setting a maximum on the number of years that a borrower could move backward (or forward) on the amortization schedule. The loan contract could also specify a maximum amortization period. In the example shown in Table 1, the loan contract could specify that the borrower may move backward on the schedule no more than three years. A similar restriction could be placed on prepayments for lenders who wished to do so. In addition, the contract could specify that the maximum amount permitted to remain outstanding after any installment due date is the amount that the scheduled level payment will amortize by, for example, the end of the twenty-fifth year from the date the original loan was made. These, or similar restrictions, would ensure that the borrower didn't get hopelessly behind by setting limitations on the frequency and extent to which the flexible payment provisions could be used.

Under the "maximum three year" or "maximum 25 year" restrictions used in this example, a borrower who could not meet the full amount of the fifth annual installment of $1,174.60 could move back only as far as year two. In doing so, he would be obligated to reduce the after-payment loan balance to $9,633.35 instead of the scheduled balance of $8,934.07. Thus, the minimum payment would be $475.32.

If the borrower were to take full advantage of the "maximum three years" rule for the fifth installment, the equity reserves available for flexible payments would be almost depleted. Suppose that on the due date of the sixth installment, the borrower were still in financial difficulty and could not pay the scheduled installment of $1,174.60. Under the "maximum 25-year" rule, the maximum amount that could remain outstanding after the sixth payment is the amount that could be repaid in 19 equal, annual installments of $1,174.60. This amount is $9,825.43. The before-payment loan balance is $10,596.69; thus, the minimum payment that could be made on the due date of the sixth installment without going into arrears would be $10,596.69-$9,825.43 = $771.26. If the borrower paid only $771.26 for this sixth payment, the flexibility feature of the repayment plan would have been entirely used up and he would be committed to paying annual installments of at least $1,174.60 for the next 19 years.

The details of these calculations would vary according to when, how often, and the extent to which the borrower reduced the payment below the scheduled amount on any given installment due date. The calculations might appear complex; however, a carefully designed billing system should make the payment plan flexible and readily understandable. To illustrate, the billing statements for the fifth and sixth installments for this example could contain the information shown in Table 2.

TABLE 2. EXAMPLE OF BILLING STATEMENT INFORMATION FOR A FLEXIBLE LOAN REPAYMENT PLAN

Installment No. 5	
Original Loan	$10,000.00
Interest Rate	10 percent
Balance Before Scheduled Installment	$10,108.67
Scheduled Installment	$ 1,174.60
Balance After Scheduled Installment	$ 8,934.07
Minimum Payment[a]	$ 475.32

[a]Note: If you pay only the minimum amount due now, the minimum amount due next year will be $771.26.

Installment No. 6[b]	
Original Loan	$10,000.00
Interest Rate	10 percent
Balance Before Scheduled Installment	$10,596.69
Scheduled Installment	$ 1,174.60
Balance After Scheduled Installment	$ 9,422.09
Minimum Payment[c]	$ 771.26

[b]Assuming the borrower paid the minimum amount, $475.32, for the fifth installment.

[c]Note: If you pay only the minimum amount due now, the minimum payment for the next 19 installments will be $1,174.60.

As Table 2 illustrates, there is a constant incentive for the borrower to pay as much as possible on each installment due date so that equity reserves can be carried to future years. Depending upon the restrictions used, the lender retains enough control so that corrective action can be taken on serious default problems before loan losses occur. At the same time, the borrower has some latitude to vary the payment in response to changes in repayment ability without going into arrears.[2]

GRADUATED REPAYMENT PLANS

The fixed, level payment amortization plan is sometimes unsuitable for the young, beginning farmer who may be carrying a very high debt load. One solution is a loan amortization plan in which the payment increases during the life of the loan.

[2]Baker has described a plan under which the mortgage payment would be adjusted according to changes in the borrower's income and living costs. An insurance element would provide a constant payment to the lender. See Baker, C.B., "A Variable Amortization Plan to Manage Farm Mortgage Risks," *Agricultural Finance Review*, E.R.S., USDA, Vol. 36, April 1976, pp. 1-6.

One version is to require payment of "interest only" during the first few years and then convert to a level payment plan to amortize all or part of the principal balance. In our example, the borrower might be required to make interest payments of $1,000 for the first five years. The $10,000 balance could then be amortized over the remaining 15 in equal, annual payments of $1,314.74.

Several variations of the interest only concept are possible. One is to call for payments of interest only throughout the entire life of the loan contract, leaving a "balloon payment" for the entire principal. This balloon would have to be refinanced or paid off at maturity. Alternatively, the contract could ask for partial amortization, with a balloon payment for the balance. In our example, the contract might specify that $5,000 be amortized over 20 years with interest only on the remaining $5,000. For a 10-percent loan, the annual payment would be $587.30 on the $5,000 amortized portion plus $500 interest on the nonamortized portion, for a total annual payment of $1,087.30.

The interest only method is generally the best a lender can do because a payment of anything less than the interest would cause the after-payment loan balance to exceed the original amount of the loan. In most cases, some increase in the principal balance above the original amount of the loan is possible because rising land values tend to preserve the lender's security margin. Exceptions would be where the security consists largely of buildings and equipment, or where land values are static or declining.

Table 3 illustrates a loan amortization schedule in which the payment increases continuously over the life of the loan at the rate of 4 percent a year.[3] Since the first few payments do not cover interest on the unpaid balance, the after-payment loan balance increases slightly, to a peak of $10,277 at the end of year four. The before-payment loan balance also increases to a peak of $11,305 just before the due date of the fifth payment.

The effects of the interest rate, the term of the loan, and where applicable, the payment growth rate on loan payments are shown in Table 4. For any given loan interest rate and amortization period, an increase in the payment growth rate tends to lower payments in the early years and increase payments in the last few years. Higher payment growth rates also cause an increase in the amount by which the loan balance will go above the original amount of the loan before finally decreasing. These characteristics are illustrated in Figures 1 and 2 for a $10,000, 10-percent loan amortized over 20 years.

A continuously graduated payment plan has two advantages over the level payment and interest only plans. Depending on the growth rate used, the first few

[3]The mechanics of computing payments for graduated payment plans are described in the appendix.

TABLE 3. AMORTIZATION OF A $10,000, 10-PERCENT LOAN IN 20 YEARS, 4-PERCENT PAYMENT GROWTH RATE

Year	Loan Balance Before Payment	Total Payment	Principal	Interest	Loan Balance After Payment
			dollars		
0	–	–	–	–	10,000.00
1	11,000.00	889.81	110.19	1,000.00	10,110.19
2	11,121.21	925.40	85.62	1,011.02	10,195.81
3	11,215.39	962.42	57.16	1,019.58	10,252.97
4	11,278.27	1,000.92	24.38	1,025.30	10,277.35
5	11,305.08	1,040.95	13.21	1,027.74	10,264.13
6	11,290.54	1,082.59	56.18	1,026.41	10,207.95
7	11,288.75	1,125.89	105.09	1,020.80	10,102.86
8	11,113.15	1,170.93	160.64	1,010.29	9,942.22
9	10,936.44	1,217.77	233.55	994.22	9,718.67
10	10,690.53	1,266.48	294.61	971.87	9,424.05
11	10,366.46	1,317.14	374.74	942.40	9,049.32
12	9,954.25	1,369.82	464.89	904.93	8,584.43
13	9,442.88	1,424.61	566.17	858.44	8,018.27
14	8,820.09	1,481.60	679.77	801.83	7,338.49
15	8,072.34	1,540.86	807.01	733.85	6,531.48
16	7,184.63	1,602.50	949.35	653.15	5,582.13
17	6,140.34	1,666.60	1,108.39	558.21	4,473.74
18	4,921.11	1,733.26	1,285.89	447.37	3,187.85
19	3,506.64	1,802.59	1,483.81	318.78	1,704.05
20	1,874.46	1,874.46[a]	1,704.05	170.41	—

[a]Last payment adjusted for minor rounding error.

TABLE 4. COMPARISON OF PAYMENT SCHEDULES FOR AMORTIZING A $10,000 LOAN UNDER LEVEL PAYMENT, INTEREST ONLY, AND GRADUATED REPAYMENT PLANS

			Interest Only First Five Years		Graduated Payments					
					2%		4%		8%	
Term	Interest Rate	Level Payment	Years 1 to 5	Years 6 to Maturity	First Payment	Final Payment	First Payment	Final Payment	First Payment	Final Payment
- Yr -	- % -	—	$	—	—		$			—
10	8	1,490.29	800	2,504.56	1,378.14	1,647.00	1,272.42	1,811.05	1,080.00	2,158.92
	10	1,627.45	1,000	2,637.97	1,509.36	1,803.83	1,397.62	1,989.25	1,193.03	2,384.86
	12	1,769.84	1,200	2,774.10	1,646.05	1,967.18	1,528.46	2,175.48	1,311.97	2,622.64
20	8	1,018.00	800	1,168.30	880.81	1,283.17	754.86	1,590.38	540.00	2,330.48
	10	1,174.60	1,000	1,314.74	1,026.80	1.495.85	889.81	1,874.46	651.09	2,809.90
	12	1,338.79	1,200	1,468.24	1,040.40	1,515.67	1,035.13	2,180.85	773.97	3,340.24
30	8	888.27	800	936.79	731.71	1,299.41	590.25	1,840.78	360.00	3,354.22
	10	1,060.79	1,000	1,101.68	892.66	1,585.23	736.99	2,298.41	472.45	4,401.96
	12	1,241.44	1,200	1,275.00	1,064.35	1,890.12	897.12	2,797.81	602.29	5,611.72

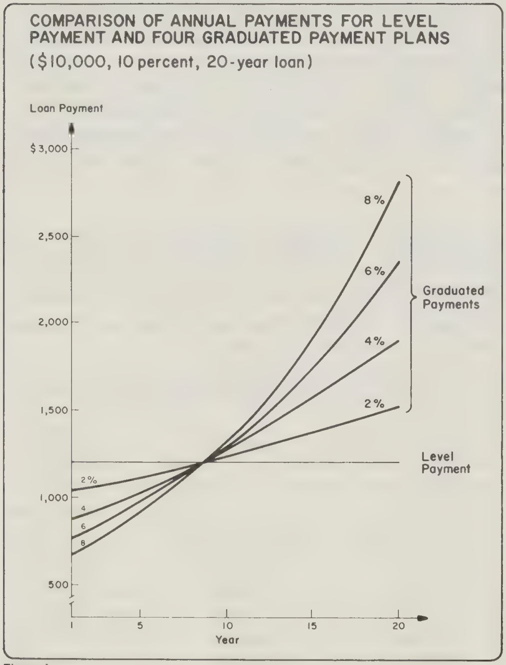


Figure 1

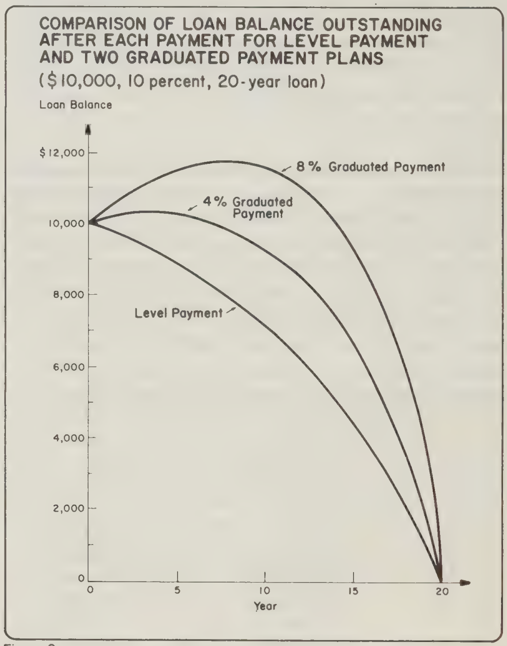


Figure 2

payments will be somewhat less than the interest only and level payment amounts. Compared with the level payment plan, a 4-percent payment growth rate plan throughout the entire term of the loan reduces the first payment on a $10,000, 10-percent, 20-year loan from $1,174.60 to $889.81. On a $100,000 loan, the absolute reduction in the first annual payment would be about $2,848. Thus, a graduated payment plan woud give beginning farmers a better chance of keeping their loan accounts in good standing during the typically difficult early years in farming. Under a steadily increasing payment plan the sudden increase from the interest only amount to a level payment is eliminated. Of course the interest only and graduated payment plans could be combined. For example, the mortgage contract could call for interest only payments of $1,000 for the first five years, followed by a 4-percent graduated payment schedule over the next 15. Under this plan, the sixth payment would be $1,054.73 and it would gradually increase to $1,826.45 for the final twentieth installment.

Graduated payment plans do not have to involve a

continuous increase in the payment throughout the entire amortization period. The borrower could be required, or given the option to switch to a level payment plan on specified loan anniversary dates. The $10,000, 10-percent, 20-year loan could be written so that the first 10 payments increased at a rate of 5 percent a year and the last 10 be equal. In this case, the first payment would be $885.06, the tenth $1,373.02, and payments 11 through 20 would be $1,441.67.

Graduated payment plans could also incorporate the provisions of a flexible payment plan, allowing limited movements backward or forward on the payment schedule. The degree of flexibility would be less with a graduated payment plan because the borrower's equity increases at a much lower rate.

Lenders have two main objections to loan repayment plans which call for lower payments in the loan's early years. The security margin is lower than it otherwise would be under the level payment plan, and there is the added risk that the borrower's repayment capacity may not increase fast enough to handle the higher payments in the later stages of the amortization period. These objections can be partially overcome by choosing realistic payment growth rates, tailored to the anticipated inflation rate in the value of the security and the expected growth rate in the borrower's income.

VARIABLE INTEREST RATES

Most farm mortgage loans in Canada carry a fixed interest rate for the entire term of the loan. In the Canadian residential housing mortgage market, the typical loan contract calls for renewal of the loan every five years at a new interest rate determined by prevailing market rates. In the United States, the Production Credit Association and the Federal Land Banks (the largest suppliers of farm credit) have been making variable interest rate farm loans since about 1970.

At first glance, variable interest rate loans appear to benefit only lenders. Variable rate loans allow lenders to pass to borrowers the risk of getting locked into a long-term loan with a low, fixed rate of return. Borrowers, however, also assume considerable risk when they borrow over long terms at fixed interest rates. The general interest rate level tends to rise and fall in largely unpredictable cycles so some borrowers become locked into comparatively high rates over long terms. From the lender's standpoint, interest earnings on loans to borrowers who are locked into cyclically high rates tend to offset low rates of return on loans made when interest rates were low. Borrowers, however, do not have an effective means of dealing with the risks of interest rate changes.

Variable rate farm mortgages could benefit both lenders and borrowers. Consider a borrower who obtained a $10,000 FCC loan on December 1, 1968 at the interest rate of 8 percent a year. For convenience, it was assumed that the loan is to be repaid over 20 years in annual installments due the first of every December, and that the interest rate could be adjusted only once a year on each payment due date. Since the interest rates on FCC loans are subject to change every April 1 and October 1, the variable rates on this loan would be as shown in columns 2 and 3 of Table 5. The new rate each year is the rate in effect after each October 1 rate adjustment.

The payments on this variable rate plan would be as shown in column 5 of Table 5. In any given year, the payment is the amount needed to amortize the after-payment loan balance over the remaining years to maturity at the new interest rate. The first payment, $1,018.52, would amortize a $10,000, 8-percent loan in 20 years. The second payment, $1,074.10, would amortize a $9,781.48, 8.75 percent-loan in 19 years, and the fifth payment (December 1, 1973) $956.02, would amortize a $9,031.15, 7-percent loan in 16 years, etc.

TABLE 5. FIRST NINE PAYMENTS ON A $10,000 VARIABLE INTEREST RATE LOAN AMORTIZED IN 20 YEARS

Payment Due Date	Interest Rate		Years To Maturity	Payment	Loan Balance	
	Preceeding 12 Months	Next 12 Months			Before Payment	After Payment
	– %	–		–	$	–
Dec. 1, 1969	8.00	8.75	19	1,018.52	10,800.00	9,781.48
Dec. 1, 1970	8.75	8.50	18	1,074.10	10,637.36	9,563.26
Dec. 1, 1971	8.50	7.50	17	1,056.07	10,376.14	9,320.07
Dec. 1, 1972	7.50	7.00	16	987.93	10,019.08	9,031.15
Dec. 1, 1973	7.00	7.00	15	956.02	9,663.33	8,707.31
Dec. 1, 1974	7.00	9.25	14	956.02	9,316.82	8,360.81
Dec. 1, 1975	9.25	9.00	13	1,088.95	9,134.18	8,045.23
Dec. 1, 1976	9.00	10.00	12	1,074.57	8,769.30	7,694.73
Dec. 1, 1977	10.00	–	11	1,129.30	8,464.20	7,334.90

Source: Interest rate data in columns 1, 2 and 3 are from the Farm Credit Corporation, *Statistics 1977: Federal Farm Credit*, p. 28.

Variable interest rate loans clearly introduce some uncertainty for farm borrowers. Under a fixed rate loan, the borrower in the example in Table 5 would have paid $1,018.52 every year. The variable rate loan causes the payment to go above this amount, as shown in column 5 of Table 5. The problem of payment fluctuations caused by interest rate changes can be at least partially resolved by allowing limited changes in the amortization period described earlier for flexible loan repayment schedules. For example, the variable rate contract could specify that the borrower could maintain the same payment as long as the amortization schedule is not increased more than three years from the original schedule. In this case, the "maximum three year" rule would almost completely eliminate payment fluctuations caused by the interest rate changes.

This example demonstrates that if there is no rate differential between fixed and variable rate loans, the borrower would have been better off with an 8-percent fixed rate loan taken out in 1968. Although the absolute differences are not large, the total payments made, the remaining loan balance, and the total interest paid over the first nine years are all lower with the fixed interest rate loan. Lenders, however, will likely be able to offer lower interest rates on variable rate loans because the risk of losses on loans made when interest rates were at a cyclical low is less. In a previous article, the risk premium for interest rate fluctuations in Canada for 1969-76 was estimated to be 0.83 percent.[4] Thus, lenders could offer a lower initial interest rate as an incentive to borrowers willing to accept variable rate loans.

REVERSE MORTGAGES

A reverse mortgage is the opposite of a conventional mortgage loan. The lender makes regular payments to the borrower and at the end of the term, the borrower owes the lender a lump sum. Reverse mortgages have been proposed to help older homeowners use their home equity to supplement their retirement incomes without selling property. The same concept applies equally well to retiring farmers.

The same $10,000, 10-percent, 20-year example described previously can also be used to illustrate the mechanics of a reverse mortgage. Consider a 65-year-old farmer planning to retire who would like to keep his farm, continue to live in the house, and rent the land out to a younger neighbor. He has determined, however, that his rental income and pension benefits would be insufficient to cover the retirement living costs. Depending upon the amount of equity in the farm, a reverse mortgage might solve the problem. Suppose that a reverse mortgage contract is designed so that this farmer would owe the lender $10,000 at the end of 20 years. With an interest rate of 10 percent a year, the lender could pay the retired farmer $174.60 a year for 20 years (the reader can verify that the accumulated principal and interest on 20 annual payments of $174.60 would be $10,000 after 20 years).

Reverse mortgages have some potential problems. One obvious one, though not very likely in this example, is that if the retiree outlives the term of the mortgage, he would have no way of paying off the loan. Also, if the retiree dies before the end of the term, the lender would have to collect the loan balance due at that point from the estate.

Collecting the loan from the estate poses only a minor administrative problem for the lender (as long as the security's value has not decreased substantially – an unlikely occurrence given the recent trends in values). The problem of the retiree (and spouse) outliving the term of the mortgage could also be resolved by tailoring loan terms to life expectancy, just as insurance companies do with annuities. Furthermore, with rising land values, retirees who do outlive the term of a reverse mortgage would probably have accumulated sufficient additional equity to extend the term of the loan.

As with the plans described earlier, there are many possible variations of the reverse mortgage concept. For example, the payments could be graduated so that the retiree's income would keep pace with inflation. With minor adjustments, variable interest rates could also be used.

SUMMARY

Most farm mortgage loans made in Canada carry a fixed interest rate and call for a fixed, level payment that amortizes the loan over a specified term. For some borrowers, this type of loan contract may not be suitable. Year-to-year variations in farm incomes might result in periodic arrears, even though the average income over time is adequate to cover scheduled installments. Highly indebted, beginning farmers may find it difficult to meet payments in the early years. The fixed interest rate exposes both lenders and borrowers to the risk of becoming locked into unusually low or high rates for the duration of a long-term contract. Finally, many retiring farmers are forced to sell their farms to use their equities as a source of retirement income.

[4]See Lee, Warren F., "Problems in Financing Canadian Agriculture," *Canadian Journal of Agricultural Economics,* July 1976, pp. 32-45.

Many of these problems can be partially resolved by using one or a combination from four variations of the typical farm mortgage loan contract: 1. a provision for limited variations in loan payments in response to changes in repayment ability, 2. a graduated payment plan in which the loan is amortized by payments that increase over time, 3. variable interest rate loans which call for periodic adjustment in the interest rate in response to changing market rates, and 4, reverse mortgages in which the lender would pay the borrower regular payments over the term of the loan.

The plans illustrated here are only a few examples of how such loan repayment plans might work. The details can be varied considerably to suit each borrower's or lender's situation. Because these plans are new, little is known about the administrative costs, possible legal obstacles, and other problems. With computerized billing systems and some imagination, however, an innovative lending agency could probably overcome most of the major obstacles and offer better service to a wider range of borrowers.

APPENDIX

The computer and the comparatively recent development of moderately priced electronic calculators have made it possible to expand the range of available options for repaying loans. From a computational standpoint, almost any repayment plan that is agreeable to both lender and borrower is possible. The purpose of this appendix is to elaborate on the mechanics of computing the first loan payment for graduated loan repayment plans.

In any loan repayment plan, the present value of the stream of payments is equal to the initial amount of the loan. The following notation is used:

B = beginning loan balance,
r = rate of interest on loan,
g = payment growth rate for graduated payment loans, and
n = the term of the loan.
$PVA_{i,t}$ = the present value of an annuity of 1 for t periods with an interest rate of i percent per period compounded.
$PV_{i,t}$ = the present value of 1, t periods at i percent per period compounded.
I_i = loan payment in year i.
$GLA_{g,n,r}$ = graduated payment loan amortization factor to compute the first payment for a payment growth rate of g percent, n loan payments, r-percent interest rate on loan.

For a loan of B to be repaid over n periods at an interest rate of r percent in equal payments, the amount of each payment is:

$$I = \frac{B}{PVA_{r,n}} \tag{1}$$

To determine the first payment for a payment stream that increases at a compound rate of g per period over the entire term of the loan, define a new interest rate, r*, where:

$$r^* = \frac{1 + r}{1 + g} - 1, \ (r > g) \tag{2}$$

For a 10-percent loan, a 20-year term, and a 4-percent payment growth rate:

$$r^* = \frac{1 + .10}{1 + .04} - 1 = .0576923$$

Next, compute the present value of an annuity for n periods (the term of the loan) with an interest rate of r* percent per period. (A computer or financial calculator is needed.) For our example,

$$PVA_{r^*,n} = PVA_{5.76923,\ 20} = 11.687928$$

Next, compute a graduated loan amortization factor:

$$GLA_{g,n,r} = \frac{1 + g}{PVA_{r^*,n}} \tag{3}$$

For our example,

$$GLA_{4,20,10} = \frac{1 + .04}{11.687928} = .088981$$

Finally, multiply the graduated loan amortization factor by the amount of the loan to compute the first payment:

$$I_1 = GLA_{g,n,r} \times B \tag{4}$$

For our example,

$$I_1 = GLA_{4,20,10} \times B = .088981 \times \$10{,}000 = \$889.81$$

The payment increases 4 percent each year and the loan is amortized as illustrated in Table 3.

If the mortgage contract calls for a graduated payment in the early years followed by a series of level payments, first determine the present value of the level payments. For a loan with a total term of n years with

payments graduated at rate g in the first s years this would be:

$$PVA_{n-s,r} \times PV_{s,r} \times I_1 (1 + g)^s \tag{5}$$

For a 20-year loan with graduated payments for years 1 through 10 and level payments for years 11 through 20, the present value of the level payment portion is:

$$\begin{aligned} &PVA_{20-10,10} \times PV_{10,10} \times I_1 (1 = .05)^{10} \\ &= 6.144567 \times .385543 \times 1.628895\ I_1 \\ &= 3.858843\ I_1 \end{aligned}$$

Next, subtract the present value of the level payment portion from the amount of the loan, i.e., B — $(PVA_{n-s,r}) (PV_{s,r}) (I_1 (1 + g)^s)$, to obtain the amount that the first s graduated payments must amortize. For our example, the first 10 graduated payments must amortize a loan of \$10,000-3.858843 I_1.

From this point, the procedure described in equations (2) through (4) is used for s years.

$$r^* = \frac{1 + .10}{1 + .05} - 1 = .047619$$

$$PVA_{r^*,s} = PVA_{4.7619,10} = 7.811805$$

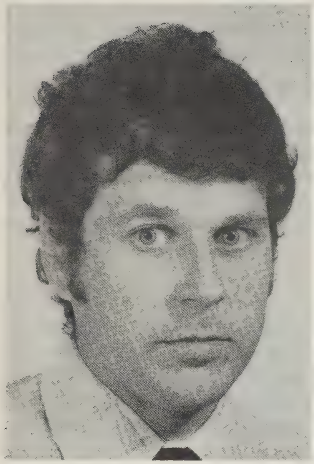
$$GLA_{.05,10,10} = \frac{1 + .05}{7.811805} = 0.134412$$

Now, solve for I_1:

$$\begin{aligned} I_1 &= (10{,}000 - 3.858843\ I_1)\ .134412 \\ I_1 &= \$885.06 \end{aligned}$$

As described in the foregoing text, payments for years 1-10 would increase 5 percent a year from \$885.06 in year 1 to \$1441.67 for years 11 through 20.

A CLASSIFICATION OF LIMITED RESOURCE FARMERS



This study was undertaken to investigate the characteristics and problems of limited resource farmers (defined here for 1970 as those with $15,000 or less gross sales and for 1975 as those with $25,000 or less) and to develop a classification system that could be used in identifying specific target groups of limited resource farmers for assistance through public and private programs. The study classifies 12 subgroups of limited resource farmers in Ontario to reflect differences in human and social constraints on behavior, farm resources, farm and non-farm employment, and income sources and levels. It also suggests possible programs to assist these subgroups.

*M. J. Trant and G. L. Brinkman**

INTRODUCTION

Throughout Canada many farmers have consistently earned low incomes, resulting in relatively low standards of living. Most of these farmers operate small units and have resources meagre in quantity and quality – land, livestock, management, or capital – to earn adequate incomes from agriculture. Some have combined farm with non-farm work, but many have remained wholely dependent on agriculture. These farmers are referred to in this study as limited resource farmers – those who reported $15,000 or less in gross sales for 1970 in the 1971 Census of Agriculture, and $25,000 or less for 1975 in the 1976 Census of Agriculture. ($25,000 in gross sales in 1975 is almost equivalent in real terms of $15,000 in 1970.)

The existence of limited resource farmers has been a persistent problem for many years. In 1970, 295,595 (81 percent) of Canada's 365,355 Census farmers had gross sales less than $15,000; 278,855 (76 percent) earned a net agricultural income less than $3,000. Over half had little or no non-farm work. In 1970, 132,840 farm families (40 percent) subsisted on total family incomes of less than $4,300, which was the 1970 low income threshold for a family of four as determined by Statistics Canada.[1] By 1975, following three years of relatively high farm incomes, 234,816 (about 70 percent) of the 338,578 farmers in the 1976 Census of Agriculture could still be considered limited resource farmers, as they produced less than $25,000 in gross sales for that year. With some declines in aggregate farm income in parts of Canada since 1975, the proportion of limited resource farmers has likely remained at or slighly above 70 percent.

For many years, government agencies have provided programs to assist farmers. Generally they have been available to all farmers (regardless of size), but most of the benefits have gone to the operators of larger, more commercial farms. Some programs, however, have been designed primarily to assist limited resource farmers through such means as farm enlargement and consolidation, and special counselling and management services. Although these programs have been helpful to many of the farmers using them, they have not been widely used by the majority of small-farm operators. Hence, they have not substantially reduced the number of limited resource farms in Canada.

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[1] Statistics Canada, "Revision of Low Income Cut-offs," working paper, Research and Analysis Section, Consumer Income and Expenditure Division, December 1973.

Since existing programs have been limited in their overall effectiveness in dealing with limited resource farmers, new programs may need to be developed and old ones modified if more small-farm operators are to be reached. For example, much of the emphasis in many programs has been on assisting limited resource farmers enlarge their farms and become viable commercial operators. These efforts have high payoffs and should be continued, but many limited resource farmers unfortunately cannot become viable commercial operators. Many are too old to justify the necessary changes, lack sufficient management capabilities, or have physical difficulties. With additional assistance, however, many of these farmers may still make substantial improvements in their farming operations and in their living standards, even if they do not wish to enlarge their farms or cannot become commercial farmers.

It must also be recognized that helping all limited resource farmers in Canada is neither practical nor possible. Some cannot use assistance, some do not want it, and some can be helped only at great cost. A few may even need non-farm assistance or general welfare if they are to be helped, and should not be considered the responsibility of agricultural ministries. It is likely, however, that many more limited resource farmers could be helped if old programs were modified or additional programs designed to meet their special needs.

As a first step to more clearly understanding limited resource farmers and developing more effective assistance programs for them, specific groups of limited resource farmers requiring different kinds of assistance must be better identified. This is the purpose of the present study.[2] In this study, groups of farmers with similar behavioral and economic characteristics, and the kinds of assistance programs expected to be most acceptable and useful for each group are identified. Hopefully, this classification system will help make assistance for limited resource farmers more effective and encourage additional efforts in this area across Canada.

METHODOLOGY

Data for the classification system were obtained through a survey of 193 farmers, divided about equally between Grey and Renfrew Counties in Ontario. The sample included a broad range of types of limited resource farmers so that it would be as useful as possible in drawing inferences for many regions of the country. Data on individual farmers' demographic characteristics, attitudes, aspirations, farm resources, management ability, alternate employment opportunities, and physical disabilities were analyzed through correlation, regression, and cross tabular analysis to form the basis of the classification.

THE CLASSIFICATION SYSTEM

The classification system consists of three main categories of 12 subgroups. The main categories consist of farm focus farmers, mixed focus farmers (part-time), and non-farm focus farmers, and reflect the farmers' involvement in and orientation to farm and non-farm employment.

The farm focus category identifies farm operators with a major orientation to and dependence on agriculture, even though they could still have a small amount of non-farm work (not competing with farm work). The mixed focus category identifies farmers with a strong involvement in both farm and non-farm work, but who still depend on agriculture as an important income source. The non-farm focus category identifies "farmers" involved in both agriculture and non-farm work, but whose primary orientation is toward the non-farm sector. These people either farm as a hobby or are involved so lightly in agriculture that it does not serve as an important income source. Categorizing farmers according to their major orientation to farm and non-farm work instead of using the popular full-time and part-time classifications avoids the problems of categorizing all farmers with non-farm work in a single category, and enables farmers to be categorized more appropriately according to their needs for assistance.

The criteria established to best represent farm focus farmers were limited resource farmers who were actively farming and did no more than 30 days of off-farm work; this group included farmers of retirement age still farming. Up to 30 days of off-farm work were allowed for farm focus farmers because this level of non-farm work did not appear to affect the work orientation of the farmers examined or compete significantly with their farm work. Mixed focus farmers were identified as farmers either working off the farm between 31 and 149 days and showing evidence of active farming regardless of gross sales (to reflect less than a full-time or major orientation to non-farm work), or working 150 or more days of non-farm work with $4,000 or more gross sales in 1975 (to indicate with a minimum gross sales some reliance on agriculture as an important income source, as determined from the farmers surveyed). Non-farm focus farmers were identified as

[2]For more detail see M.J. Trant, *Classification of Limited Resource Farmers in Ontario Based on Behavioral and Economic Characteristics*, unpublished M.Sc. Thesis, University of Guelph, 1976.

"farmers" working off the farm 150 days or more with less than $4,000 gross farm sales in 1975. Since these criteria were developed with Ontario farmers in mind, they are not necessarily applicable to other regions. They should provide, however, a basis for examining limited resource farmers in other parts of Canada.

These categories were divided according to behavioral characteristics, resources, and needs for assistance into the following subgroups:

1. Farm Focus Farmers
   - transition stage farmers
   - potential commercial farmers
   - maintenance state farmers
   - traditional farmers
   - retirement age farmers

2. Mixed Focus Farmers
   - transition stage farmers
   - potential commercial farmers
   - permanent part-time farmers receptive to change
   - permanent part-time farmers in maintenance state with an income derived mainly from agriculture
   - permanent part-time farmers in maintenance state with an income derived mainly from non-farm employment
   - traditional farmers

3. Non-Farm Focus Farmers

The classification system is summarized in Figure 1. The farmers on the left side of the farm and mixed focus categories (and at the top of the categories listed above) generally tended to be the most receptive to change, had greater management ability, and had the most potential for earning good incomes from agriculture. Farm and mixed focus farmers on the right side of Figure 1 (and at the bottom of those categories listed above) were generally the least receptive to change and the hardest to reach with current assistance programs, especially those designed for farm enlargement. Farm and mixed focus subgroups of farmers likely to benefit from similar assistance programs are listed directly above and below each other.

The classification system essentially describes farmer groups at a particular time; mobility from one category or group to another could occur. Indeed, the intention of developing the classification system was to help in the design of programs to assist farmers, where possible, in moving into viable commercial operations or more productive groups in the classification system, as well as to better help those unable to change. The individual farmer subgroups and possible programs to assist them are described in the following sections.

Farm Focus Transition Stage Farmers

These farmers tended to be young, energetic, and capable managers in the process of establishing commercial farms. Often they had limited capital and physical resources, and were investing their farm income back into their farms. These farmers are likely to benefit from land expansion and credit programs to help them enlarge their operation. Since they tended to be the most receptive to farm improvements, some may initiate expansion programs on their own.

Farm Focus Potential Commercial Farmers

This group consisted of good managers who were receptive to farm improvements. They were inclined to be middle-aged (40-55) and supported families, worked established farms, and were somewhat more security-oriented than transition stage farmers. Many had sons or daughters expecting to take over the farm in the near future (in which cases expansion programs may be appropriate). Many other farmers, however, were primarily interested in doing a better job with their existing operation. These could be helped most by credit and assistance for farm reorganization and improved livestock.

Farm Focus Maintenance State Farmers

Farmers in this group were generally moderate-to low-volume operators, primarily interested in maintaining the present condition of their farms. They tended to have moderate-sized, established farms and moderate management ability, but were reluctant to make farm improvements for a variety of reasons. Many were in their late fifties and early sixties without a son or daughter to take over the farm; others were strongly security-oriented and reluctant to take risks. Some also had physical limitations which prevented them from expanding their operations, even though they had been previously receptive to improvements. The stop-loss stabilization measures of the Agricultural Stabilization Act and provincial income protection plans are likely to be the primary assistance programs with appeal to this group. (These programs probably would have some appeal to other types of limited resource farmers, even though their benefits to the farmers would be limited by the farmer's small amount of production.)

Farm Focus Traditional Farmers

These farmers represented a significant group of limited resource farmers with generally low managerial ability and low farm acreages. They were generally averse to making changes in their farm operations,

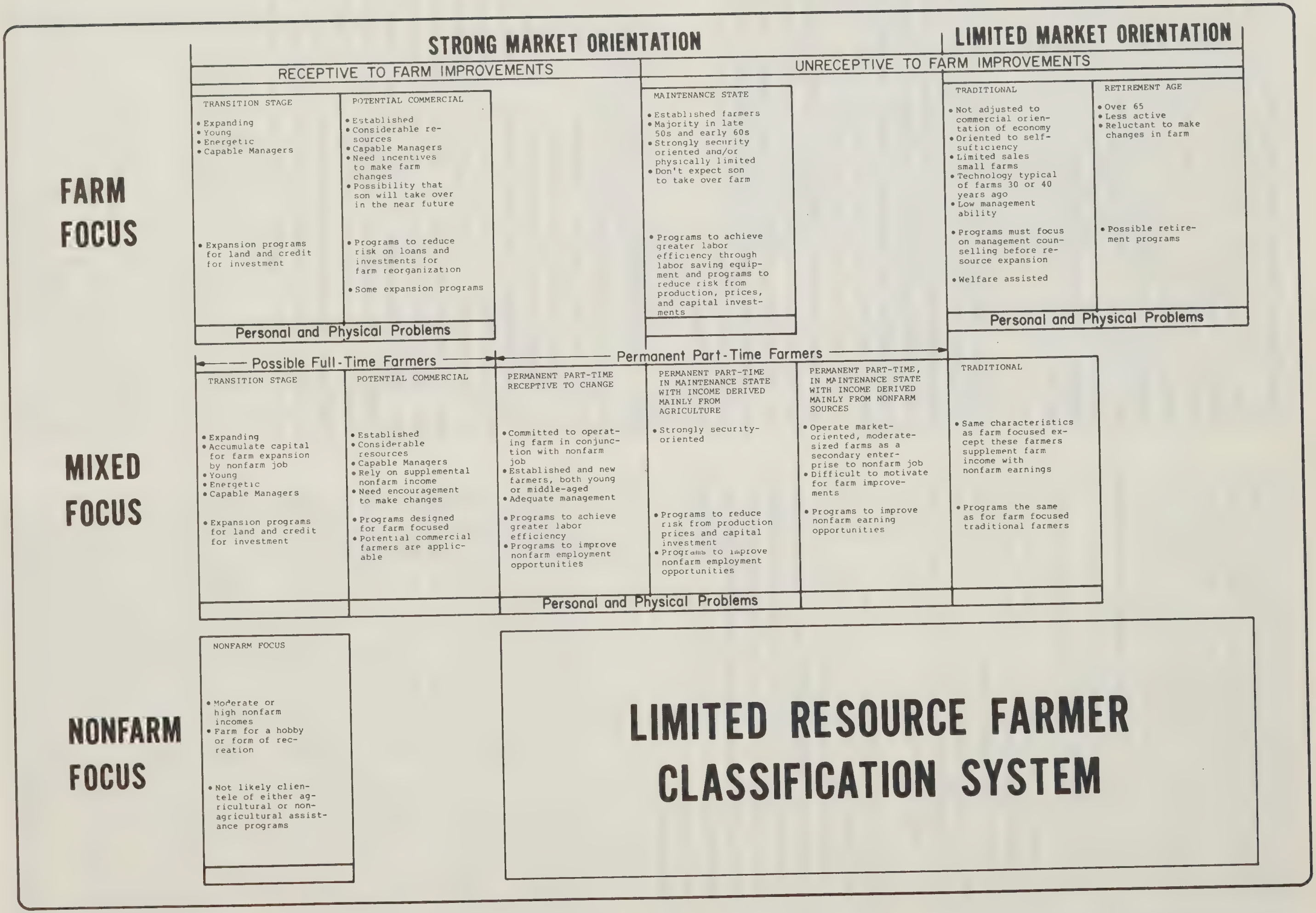
STRONG MARKET ORIENTATION
LIMITED MARKET ORIENTATION
RECEPTIVE TO FARM IMPROVEMENTS
UNRECEPTIVE TO FARM IMPROVEMENTS
FARM FOCUS
TRANSITION STAGE
• Expanding
• Young
• Energetic
• Capable Managers
• Expansion programs for land and credit for investment
POTENTIAL COMMERCIAL
• Established
• Considerable resources
• Capable Managers
• Need incentives to make farm changes
• Possibility that son will take over in the near future
• Programs to reduce risk on loans and investments for farm reorganization
• Some expansion programs
Personal and Physical Problems
MAINTENANCE STATE
• Established farmers
• Majority in late 50s and early 60s
• Strongly security oriented and/or physically limited
• Don't expect son to take over farm
• Programs to achieve greater labor efficiency through labor saving equipment and programs to reduce risk from production, prices, and capital investments
TRADITIONAL
• Not adjusted to commercial orientation of economy
• Oriented to self-sufficiency
• Limited sales small farms
• Technology typical of farms 30 or 40 years ago
• Low management ability
• Programs must focus on management counselling before resource expansion
• Welfare assisted
RETIREMENT AGE
• Over 65
• Less active
• Reluctant to make changes in farm
• Possible retirement programs
Personal and Physical Problems
Possible Full-Time Farmers
Permanent Part-Time Farmers
MIXED FOCUS
TRANSITION STAGE
• Expanding
• Accumulate capital for farm expansion by nonfarm job
• Young
• Energetic
• Capable Managers
• Expansion programs for land and credit for investment
POTENTIAL COMMERCIAL
• Established
• Considerable resources
• Capable Managers
• Rely on supplemental nonfarm income
• Need encouragement to make changes
• Programs designed for farm focused
• Potential commercial farmers are applicable
PERMANENT PART-TIME RECEPTIVE TO CHANGE
• Committed to operating farm in conjunction with nonfarm job
• Established and new farmers, both young or middle-aged
• Adequate management
• Programs to achieve greater labor efficiency
• Programs to improve nonfarm employment opportunities
PERMANENT PART-TIME IN MAINTENANCE STATE WITH INCOME DERIVED MAINLY FROM AGRICULTURE
• Strongly security-oriented
• Programs to reduce risk from production prices and capital investment
• Programs to improve nonfarm employment opportunities
PERMANENT PART-TIME, IN MAINTENANCE STATE WITH INCOME DERIVED MAINLY FROM NONFARM SOURCES
• Operate market-oriented, moderate-sized farms as a secondary enterprise to nonfarm job
• Difficult to motivate for farm improvements
• Programs to improve nonfarm earning opportunities
TRADITIONAL
• Same characteristics as farm focused except these farmers supplement farm income with nonfarm earnings
• Programs the same as for farm focused traditional farmers
Personal and Physical Problems
NONFARM FOCUS
NONFARM FOCUS
• Moderate or high nonfarm incomes
• Farm for a hobby or form of recreation
• Not likely clientele of either agricultural or nonagricultural assistance programs
LIMITED RESOURCE FARMER CLASSIFICATION SYSTEM

Figure 1

oriented toward self-sufficiency, and often operated their farms with outdated technology reminiscent of farms 30 to 40 years ago. Management was often the most limiting factor to more successful farm performance. Hence, agricultural programs to assist this group must provide management counselling as a prerequisite to other assistance. Many of these farmers, however, may be the clientele of general welfare programs rather than farm improvement programs.

Farm Focus Retirement Age Farmers

Retirement age farmers were all 65 and older but still partially active in farming, even though the farm was often a means of keeping them active and busy, rather than a commercially-oriented enterprise. These farmers were often reluctant to undertake farm improvements, particularly if they involved a large capital investment or time commitment. Possible assistance for these farmers may be made through non-agricultural programs such as pensions, or an agriculturally related program which might provide an annuity based on the equity they have built up in their farms, and which would be reclaimed from the estate upon sale of the farm on the operator's death.

Mixed Focus Transition Stage Farmers

The farmers in this group had characteristics and resources similar to those of the farm focus transition stage farmers, and were also establishing a viable commercial operation. The main difference between the two groups was that the mixed focus farmers were relying on their non-farm job to generate capital to expand their farms, rather than generating it from farming. Both groups are likely to benefit from similar credit and land acquisition programs for expansion.

Mixed Focus Potential Commercial Farmers

These farmers were also similar to their farm focus counterparts, except for the involvement in non-farm work which limited somewhat their farming activity. They could also probably benefit from similar programs for reorganization or expansion if they have a son or daughter to take over the farm.

Mixed Focus Permanent Part-Time Farmers Receptive to Change

These farmers were not contacted in the survey because of the manner in which the sample was selected, but they were identified by agricultural and ARDA (Agricultural and Rural Development Act) representatives in the two counties. These farmers can be described as progressive farmers permanently committed to both agriculture and non-farm employment. They tend to be good managers and receptive to change, but their agricultural activity is likely to be limited by their non-farm work. They should benefit from programs to improve their farm labor efficiency so that they can do more with their existing resources and available time.

Mixed Focus Permanent Part-Time Farmers in Maintenance State With an Income Derived Mainly from Agriculture

Farmers in this group tended to have many of the same characteristics as farm focus maintenance state farmers, except that they were supplementing their farm income with non-farm earnings. They were generally older (over 50), security-oriented, moderate managers operating moderate-sized farms, and primarily interested only in maintaining their current operation. Since agriculture still was their main income source, they are likely to desire stabilization programs (like the farm focus maintenance state farmers).

Mixed Focus Permanent Part-Time Farmers in Maintenance State With an Income Derived Mainly from Non-Farm Sources

These farmers had behavioral characteristics similar to those of the previous group of mixed focus farmers, but they were inclined to operate smaller farms and were primarily dependent on their non-farm job. Agriculture was still an important source of family income, however, and not treated as a hobby or pastime. Their resistance to change and their reliance on non-farm employment makes them difficult to motivate for farm improvements, and their small agricultural operations greatly limit the benefits they can obtain from most farm improvements. These farmers may require better non-farm earning opportunities to improve their well-being.

Mixed Focus Traditional Farmers

These farmers tended to be the least receptive of the mixed focus farmers, and similar to their farm focus counterparts. They were inclined to have the lowest management ability, the smallest farms, outdated technology, the lowest aspirations about farm improvements, and an orientation toward self-sufficiency. Even though they had non-farm jobs, their total income was often low, indicating that they were limited

TABLE 1. APPROXIMATE DISTRIBUTION OF FARM, MIXED, AND NON-FARM FOCUS LIMITED RESOURCE FARMERS IN CANADA BY PROVINCE, 1976[a]

Category of Farmers	British Columbia	Alberta	Saskat-chewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	Newfound-land	Canada
Total Limited Resource Farmers ($25,000 Gross Sales or Less)	16,091	42,304	42,610	22,491	61,056	38,386	3,713	4,494	2,930	741	234,816
Percent of all Farmers	83	69	60	70	69	75	82	83	80	87	70
Approximate Number of Farm Focus (0 - 30 Days of Off-Farm Work)											
Under 65	5,769	21,019	26,330	12,974	23,394	21,792	1,602	1,657	1,371	359	116,267
Over 65	1,767	4,294	5,086	2,460	8,989	3,593	537	700	449	81	27,956
Total	7,536	25,313	31,416	15,434	32,383	25,385	2,139	2,357	1,820	440	144,223
Approximate Number of Mixed Focus (31 - 149 Days or 150 Days or More with a Minimum of $5,000 Gross Sales)	2,906	9,770	8,246	4,246	12,923	6,709	616	723	569	137	46,845
Approximate Number of Non-Farm Focus (150 or More Days but Less than $5,000 Gross Sales)	5,649	7,221	2,948	2,811	15,750	6,292	958	1,414	541	164	43,748

Source: Special Census of Agriculture Tabulation by Statistics Canada.

[a]The numbers of farmers listed in the various categories of this table are only approximations as Census tabulations using the complete criteria for farm, mixed, and non-farm focus farmers identified in this study were unavailable. These figures likely overestimate the number of farm focus and underestimate the number of mixed and non-farm focus farmers because of inconsistencies in the census data from farmers earning non-farm employment income, but not reporting their days of off-farm work or reporting 70 days of off-farm work.

in their potential both on and off the farm. Like farm focus traditional farmers, they most likely would require management assistance before other help could be effective, and may be clientele of general welfare programs.

Non-Farm Focus Farmers

Non-farm focus farmers generally earned good non-farm incomes (many earning over $10,000 in total operator income in 1975) and did not rely on agriculture as a source of family support. They were farming for a hobby or recreation, seldom grossing over $2,000 from the farm. Most sustained small losses from their farm operations. Consequently, they are not likely to be the clientele of either agricultural or non-agricultural programs.

CANADA-WIDE PERSPECTIVE OF LIMITED RESOURCE FARMERS

The distribution of limited resource farmers and their income levels by province in Table 1 identifies for 1976 the number of limited resource farmers (earning less than $25,000 gross sales in 1975 as reported in the 1976 Census of Agriculture) and their percentage of the total population. The table also provides an approximation of the number of farm, mixed, and non-farm focus farmers in each province. It can be seen that 70 percent of all Canadian farms grossed less than $25,000 in 1975. The largest number of limited resource farmers (61,056) were in Ontario, but that province had one of the lowest shares (69 percent). The proportion in the Maritimes was 80-83 percent while in the Prairies it was 60-70 percent. The figures for the Prairies show great improvement over those of 1970, when 78-85 percent of the farmers in each province were in the limited resource category (Saskatchewan declined from about 85 to only 60 percent). Between 1970 and 1975 the proportion of limited resource farmers in Quebec declined 11 percent; Ontario and the Maritimes reduced their share 3 to 6 percent, but British Columbia increased its share 1 percent.

The approximate numbers of farm, mixed, and non-farm focus farmers are identified in Table 1 by modifying the criteria determined earlier for the three focus categories. In Table 1, $5,000 gross sales is used instead of $4,000 for separating mixed and non-farm focus farmers with 150 or more days of off-farm work. This is because only the $5,000 sales category was available from census data. In addition, the census figures probably underestimate the number of mixed and non-farm focus farmers, because a substantial number of farmers in the census typically do not report off-farm days or report 0 days, even though they have non-farm employment earnings. Although the study criteria were developed from analysis in Ontario and may not be entirely applicable to other provinces, they (and the modifications in Table 1) should give a reasonable approximation of the focus of limited resource farmers in each province.

Examining limited resource farmers across Canada in 1976, there were roughly 116,267 (50 percent) working age farm focus farmers, 27,956 (12 percent) retirement age farm focus farmers, 46,845 (20 percent) mixed focus, and 43,748 (19 percent) non-farm focus farmers. The highest proportions of working age farm focus farmers were generally in the Prairies, while Ontario and the Maritimes had the highest share of farm focus farmers 65 or older. The greatest number of mixed focus farmers were in Ontario, Alberta, Saskatchewan, and Quebec. Alberta, Ontario, Prince Edward Island, and Saskatchewan had the largest proportion. The greatest share of non-farm focus farmers were in British Columbia, Nova Scotia, Ontario, and New Brunswick.

It is impossible to identify the number of farmers in the various subgroups of the classification system from census data, since various behavioral characteristics were used in this classification. In the Ontario counties studied, the largest single subgroup of farmers under retirement age was the farm focus maintenance state subgroup, consisting of almost a third of the farmers studied under the age of 65. The farm and mixed focus traditional farmers also accounted for about 13 and 16 percent of the active-age farmers. The total number of farmers from all subgroups receptive to change only represented about 30 percent of the farmers under 65 years of age, with the farm focus potential commercial group the largest (16 percent of the active-age farmers). Farm and mixed focus transition stage farmers represented only about 7 and 3 percent of the active-age farmers. These figures for the transition stage farmer, however, underestimate the proportion of these farmers that may exist over a long period, since the percentages found in Ontario were only for a single point in time. The transition stage subgroups are dynamic and changing, with many farmers entering this category as they start enlarging and improving their farms, and then leaving it when they become commercial operators.

CONCLUSIONS AND IMPLICATIONS

As indicated in the classification system, limited resource farmers are not a homogeneous group. They consist of various types of farmers with different re-

sources, human characteristics, and potentials for farm improvements. They range in type from transition stage farmers in the process of enlarging their farms to traditional farmers farming much as their fathers did some time ago. Probably 30 to 40 percent of the limited resource farmers are receptive to change, but the majority are likely unreceptive to making substantial farm improvements, especially those involving farm enlargements.

Several policy implications can be drawn from this classification system. First, several programs may be necessary to reach a broad range of limited resource farmers because of their different characteristics and needs. General farm programs that are available to all farmers, like stabilization programs, dairy subsidies, and various supply management schemes may be helpful, but are not likely to provide enough assistance to make a substantial difference in the income levels of small-farm operators. The approximate 70 percent of the total farm population in the limited resource category, even in 1975 when farm incomes were at record levels in real income, may be indicative of the limitations of many of the aforementioned programs (along with some farm expansion programs designed specifically for limited resource farmers) in substantially reducing the proportion of limited resource farmers in Canada. The benefits of most general agricultural programs are typically based on the amount of a farmer's production, and these often do not provide limited resource farmers with much assistance. (Stabilization payments for a farm grossing only $10,000 may be helpful, but are probably not large enough to appreciably raise the net farm income.) Consequently, limited resource farmers need specialized programs aimed at their specific conditions and problems if more of them are to be helped.

Many past programs for limited resource farmers (focusing on farm expansion through farm consolidation, land transfer, and credit for acquiring more farm resources) are still appropriate, but might best be directed primarily at the transition stage and potential commercial farmers. Also, greater emphasis at the provincial and national level might be placed on assisting farmers make on-farm improvements and on reducing and sharing risk for those limited resource farmers not interested in enlarging their farms. These programs could be particularly useful for potential commercial farmers wishing to improve their livestock and existing farming operation, as well as many maintenance state farmers. For example, if government introduced programs to help reduce and share risk through such provisions as special loan guarantees or deferral options for loan repayments in bad years, many of the security conscious maintenance state farmers might find farm improvements more acceptable, and some might even shift to a more receptive subgroup of the classification system.

Traditional farmers are likely the hardest to assist through agricultural programs since many have behavioral characteristics which inhibit them from being fully successful in either the farm or non-farm sectors. Special management assistance might be helpful in some cases, especially when an offspring can be introduced to better farming practices than those used by the father (for use after taking over the farm), but most hard-core traditional farmers will not likely benefit much. Most of the traditional farmers might be considered part of the overall social welfare problem, and not the unique responsibility of agricultural ministries.

Retirement age farmers present a slightly different problem because many of them are not farming full time or for the same reasons as younger farmers. A significant problem facing many retirement farmers is trying to use some of their wealth that is tied up in the farm, without having to sell the farm or destroy its composition. (Most farmers studied wanted to keep the farm during their retirement.) One program for retirement farmers that might be introduced, for example, is to provide retired farmers with moderate cash payments (maybe $1,000 – 3,000 a year) based on their equity in the farm, with principal and interest deducted and repaid from the farm value when the farm was finally transferred or sold. This kind of program could enable retired farmers to both retain ownership of the farm and to utilize some of its value for consumption while they are still able to use it.

Other implications of the classification system relate to field staff and their relationships with limited resource farmers. One of the areas where field staff can have a large impact is through management training. Many of the farmers analyzed in this study used relatively poor management practices and neglected such standard practices as proper feeding and fertilizer use. In fact, improved management could have been beneficial to farmers in all of the subgroups in the classification system. Although limited resource farmers may be harder to approach than commercial farmers and do not ususally seek out assistance, many will respond when appropriate efforts are made to approach them (especially the receptive-to-change groups). Field staff can also increase their effectiveness by focusing on adjustments that are likely to be acceptable to the farmers being helped (such as reducing risk for maintenance stage farmers and identifying more efficient

on-farm resource use for potential commercial farmers not interested in enlarging their farms).

Many of the farmers studied greatly increased their interest in making farm improvements at the time when their son or daughter was considering whether or not to leave the farm for other work. At this stage the farmer was forced to consider developing the farm into a larger, more productive unit if he wanted his child to stay on; this was one of the most receptive periods in the farmer's life. Field staff should recognize this particularly receptive period as maybe a once in a lifetime opportunity to help these farmers.

These policy implications should provide an idea of the importance of a classification system for limited resource farmers, as well as suggest some potential programs to meet their various needs. In the later stages of the overall project, additional research is being conducted to examine, in more detail, some of the behavioral aspects of these farmers, particularly on how to approach them and to get them to participate more readily in assistance programs. Research is also being conducted to identify programs that will be acceptable to limited resource farmers and more effective in solving their problems. Hopefully, the classification system and the related research will provide a stronger basis for working with limited resource farmers in Canada.

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ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE – MARCH 1979

Item	Units or Base	1977 I	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual
Production and Income											
1. GNP at Market Prices[a]	$ mil.	202,852	207,956	212,308	217,412	210,132[b]	222,684[b]	229,600[b]	235,364[c]	239,692	231,835
2. Farm Cash Receipts Total[d]	$ mil.	2,660.0	2,222.9	2,624.3	2,664.8	10,171.9	2,904.0	2,705.6[c]	2,954.7[c]	3,323.1[c]	11,879.5
3. – Total Crops[d]	$ mil.	1,427.0	754.5	1,107.5	1,140.0	4,429.0	1,468.8	1,004.7[c]	1,148.6[c]	1,312.3[c]	4,934.4
4. – Total Livestock[d]	$ mil.	1,142.7	1,308.6	1,393.4	1,401.1	5,245.8	1,354.6	1,608.6[c]	1,711.2	1,894.3[c]	6,568.7
5. Net Income Rec'd by Farm Operators[a]	$ mil.	2,800.0	3,656.0	2,940.0	2,744.0	3,035.0	3,480.0[b]	4,800.0[b]	4,172.0[b]	4,528.0	4,244.0
Trade											
6. Agricultural Exports	$ mil.	941.0	1,115.0	1,120.0	1,088.9	4,264.9	945.4	1,230.5	1,261.4	1,390.1[c]	4,828.4[c]
7. Agricultural Imports	$ mil.	867.0	980.5	827.5	880.9	3,555.8	876.6	1,088.5	943.2	1,104.4[c]	4,012.7[c]
8. Real Domestic Product, Ag[a]	1971=100	95.5	100.6	104.2	104.8	101.3	109.9[b]	107.4[b]	109.8[b]	108.9	109.2
9. Real Dom. Prod. Less Ag[a]	1971=100	129.3	129.4	130.2	131.1	130.0	132.2[b]	133.4[b]	134.8[b]	136.7	134.2
Price Indexes											
10. Farm Input Price Index	1971=100	175.6	181.2	181.3	181.7	180.0[c]	187.3	196.7	199.7	205.5	197.4[c]
11. – Buildings and Fencing	1971=100	177.9	180.8	186.7	190.0	183.9	193.4	197.6	203.1	209.7	201.0
12. – Machinery & Motor Veh.	1971=100	159.9	163.7	165.0	169.1	166.4	172.6	174.0[b]	176.0[b]	181.7	176.1
13. – Crop Production	1971=100	207.8	210.6	214.1	214.5	212.5	217.9[b]	224.1[b]	207.0[b]	229.5	224.6
14. – Animal Production	1971=100	162.0	173.2	169.3	165.2	167.4	178.0	203.7	207.3[b]	217.7	201.7
15. – Hired Farm Labor	1971=100	203.2	207.0	211.0	213.0	208.6	214.5	217.9	223.9	225.4	220.4
16. – Interest	1971=100	242.8	242.8	242.8	242.8	242.8	242.8	242.8	242.8	242.2	242.8[c]
17. Farm Prices of Ag. Prod.[d]	1961=100	213.1	222.1	218.8	216.4	217.6[b]	222.2[be]	234.6[e]	210.7	NA	NA
Input and Credit											
18. Farm Impl. & Equip. Sales[f]	$ mil.	163.7	298.3	379.1	283.4	1,124.5	153.9	372.9	418.8	342.4	1,288.0
19. Employment in Agriculture[a]	'000	461.7[b]	464.7[b]	470.3[b]	472.7[b]	468.0	460.3	466.0	481.7	495.3	475.8
20. Av. Farm Labor Rates[d]	$/hr	3.49	3.54	3.61	3.66	3.56	3.67	3.73	3.78		
21. Av. Hourly Earnings-Manuf.	$/hr	6.16	6.34	6.44	6.57	6.38	6.67	6.77	6.87	7.03[c]	6.84[c]
22. F.C.C. – Gross Loan Disburs.	$ mil.	77.8	129.9	175.7	125.4	508.8	78.4	127.8	205.7	121.7	533.6
23. F.I.L. – Loans Made	$ mil.	24.9	51.6	53.1	34.1[c]	163.7	37.8[c]	NA[g]	NA	NA	NA
24. CPI – All Items	1971=100	155.5	159.1	162.6	166.1	160.8	169.2	173.3	177.7	180.5	175.2
25. – Food at Home	1971=100	168.0	175.9	182.7	188.6	178.8	194.8	208.3	218.7	216.4	209.6
26. – Food Away from Home	1971=100	184.1	185.8	188.3	190.0	187.0	192.6	194.9	202.2	207.3	199.3
27. Industry Selling Price Index – Food & Beverage	1971=100	178.8	187.3	187.9	189.2	185.9	194.9	203.9	209.5	213.5[c]	305.5[c]
Other Indicators											
28. Unemployment Rate[a]	%	7.9[b]	8.0[b]	8.2	8.4	8.1	8.4	8.6	8.5	8.2	8.4
29. Exchange Rate	$ U.S.	1.03	1.05	1.07	1.10	1.06	1.11	1.13	1.14	1.18	1.14
30. Av. Rate on New Demand Loans	%	9.1	9.1	8.6	8.7	8.9	8.7	9.7	10.0	12.32	10.18
31. Quarterly Pop. Est.	mil.	23.16[b]	23.22[b]	23.28[b]	23.34[b]	23.16[b]	23.39[b]	23.44[b]	23.50	23.55	

[a]Seasonally-adjusted at annual rates.
[b]Revised.
[c]Preliminary.
[d]Excludes Newfoundland.
[e]Based on current initial prices only for wheat, oats, and barley in Alberta, Saskatchewan, and Manitoba.
[f]Excluding repair parts.
[g]NA = not available.

NOTES

PROPOSED AMENDMENTS TO THE FARM CREDIT ACT

Agriculture Minister Eugene Whelan will introduce new legislation in Parliament to allow the Farm Credit Corporation (FCC) to obtain additional funds from sources other than the Government of Canada.

Proposed amendments to the Farm Credit Act would give the corporation authority to borrow some of its funds in the private financial market.

Mr. Whelan said the amendments would assist the FCC to more fully meet the needs of Canadian farmers in a period of Governmental budgetary restraint. It would have the added advantage of giving the FCC a way of reacting faster to major changes in the demand for farm credit.

The demand for long-term agricultural credit has increased since 1973 at a rate of about 15 percent a year. Forecasts indicate the demand could double between 1978 and 1981 to reach $1.85 billion. The FCC has been administering the Farm Credit Act for 20 years. It has disbursed about 143,000 loans totalling more than $4.6 billion. At the end of the 1977-78 fiscal year, the FCC had 72,000 active loans for a total of $2.6 billion. More than 65 percent of the long-term credit extended to Canadian farmers in recent years has been provided by the FCC.

STABILIZATION PAYMENTS FOR GRAINS

Agriculture Minister Eugene Whelan has announced stabilization payments for the 1977 barley crop grown outside the Canadian Wheat Board (CWB) designated area, and for the 1977 Canada Eastern winter wheat crop. There will be no payment for oats because the support price for oats grown outside the Wheat Board area in 1977-78 is $94.02 a tonne, the same as the average market price for the commodity.

Producers will receive a deficiency payment of $7.35 a tonne (16 cents a bushel) on barley sold between August 1, 1977 and July 31, 1978. Payment will be based on barley at 14 percent moisture. Payments will be made only on commercial sales.

Barley grown outside the CWB designated area is a named commodity under the Agricultural Stabilization Act. It receives support at 90 percent of the five-year average market price, indexed to reflect changes in the cash costs of production. This is the first time a stabilization payment has been made for barley.

The weighted average market price during the crop year was $80.84 a tonne ($1.76 a bushel), and the support price was $88.19 a tonne ($1.92 a bushel). Malting barley and seed will be included in the program.

Mr. Whelan said the government expects to make payments on about 25 percent of the total crop of 19 million bushels grown outside the Wheat Board area. Maximum eligibility under the barley program will be 160 tonnes, with a two-tonne deduction.

Winter wheat is not a named crop under the Agricultural Stabilization Act, but the federal government is making the support payment because of low prices paid for the 1977 harvest. The payment is $31.97 a tonne (87 cents a bushel).

In 1977, the Ontario winter wheat crop was a record 822,000 tonnes (30.2 million bushels). The United States also had a large crop of winter wheat and prices in both the domestic and international markets were depressed. Grower returns averaged $83.41 a tonne ($2.27 a bushel).

The support price is $115.38 a tonne ($3.14 a bushel), 90 percent of the average market price for the previous five years, adjusted for changes in cash production costs. The support payment is the difference between the support price and the average market price in the 1977-78 crop year.

The total payment is expected to amount to about $26 million.

Most of the wheat grown in Eastern Canada is winter wheat grown in Ontario and used mainly for cake and pastry flour.

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IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we will try to accommodate you.

When forwarding your "In Reply" or letter, indicate if we may publish your comments in a subsequent issue.

Steven E. Kraft, a resource economist at the University of Saskatchewan, likes having the pages on publications. About L. M. Johnson's article, "Economic Analysis of Crop Rotations in Western Canada," he says, "A more detailed discussion of how the data were acquired and an indication of how representative they were would have been useful."

With reference to the same article, Gust Oja, a Saskatchewan farmer, comments that he would appreciate an occasional statistical breakdown of "smaller geographical regions, for example, ten rural municipalities in the extreme south-west corner of Saskatchewan."

Another farmer, Robert R. Ferguson of Fort Qu'Appelle, on the other hand, would have found it "useful if one of the east-central areas of the (same) province had been chosen in the sample for crop rotations."

Dr. Mark B. Lapping, associate professor of resource planning at the University of Vermont, found T. C. Gunn's article, "Part-Time Farming in Nova Scotia," useful. "This is a growth phenomenon here in New England, too," he says. "Yet there is little data and not much recognition given to the ever-expanding number of part-time farmers and their impacts on their communities, local markets, etc. This paper does, however, provide some excellent information."

Lester M. Settle, the secretary-manager of the Nova Scotia Federation of Agriculture, says that the same article added to the information he already had from T. C. Gunn. He comments, "This issue is one of major concern to us in Nova Scotia as we plan future agricultural development programs."

IN REPLY TO AUTHORS AND EDITORS REGARDING FEBRUARY - APRIL 1979
CANADIAN FARM ECONOMICS

I have read one or more of the following articles:

(1) Government Policies for the Canadian Dairy Industry
(2) Some Alternatives to Conventional Farm Mortgage Loan Repayment Plans
(3) A Classification of Limited Resource Farmers

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

not useful 1 2 3 4 5 6 7 8 9 10 very useful

3. Why?

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CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

VOLUME 14 NUMBER 3 JUNE 1979

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. JOHN WISE, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

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FORECASTING FARM CREDIT REQUIREMENTS FOR 1981

Farm credit requirements in 1981 should fall between \$7.7 and \$9.4 billion, depending on farm income levels and the general inflation rate. Under moderate economic conditions, the 1981 forecast is for \$8.1 billion, about \$2.1 billion higher than the estimated amount of farm credit extended in 1976. This increase represents a 6-percent compound annual rate of increase over the 1976-81 period, much less than the 18-percent rate of increase over the 1971-76 period. It is estimated that operating expenses will account for about 63 percent of the total 1981 farm credit requirements, real estate transfers about 20 percent, and non-real estate investment about 17 percent.

*F.L. Tung and W.D. Jones**

INTRODUCTION

Credit flow to farmers has been increasing at a compound annual growth rate of about 18 percent during the last six years.[1] Escalating demand for farm credit is expected to continue into the 1980s as structural changes in the industry combined with general economic inflation increase both the quantities and prices of resources used by the farm industry. There is concern about the industry's increasing dependence on credit as a source of investment and operating capital.

When production involves extensive use of credit, production costs increase because of interest charges. Farm credit also plays a role in allocating limited productive resources within the farm industry. Thus availability and terms of credit have a significant impact on producer's incomes and the industry's production efficiency.

Expected growth rates in the demand for farm credit create the need to examine the adequacy of financial markets and credit programs used by agricultural producers. Such analysis requires forecasts of farm credit needs.

The present study generates medium-term forecasts of investment and operating capital requirements and the concomitant credit flow. Specifically, capital and credit trends for 1971-76 and forecasts for 1981 are examined under three different levels of economic performance.

Demand for farm credit is determined by the amount of capital funds required and the ability of farm operators to generate internal funds.[2] The observed patterns of financing capital fund requirements during the 1971-76 period are examined in the first section. The method used to forecast credit requirements for 1981 is described in the second, and the final section presents the forecast results and some related implications.

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*F.L. Tung and W.D. Jones are economists with the Regional Development Analysis Division and Production Analysis Division, respectively, of the Agricultural Development Directorate, Policy, Planning and Economics Branch, Agriculture Canada, Ottawa. The authors acknowledge assistance in the collection of data by Dr. R. Bollman of Statistics Canada, and helpful comments received from him, Dr. R.S. Rust, and anonymous reviewers. Any errors or omissions, however, remain the sole responsibility of the authors.

[1] Based on data presented by R.S. Rust, "Farm Finances," *Market Commentary*, Agriculture Canada, December 1977, pp. 32-43.

[2] This is based on the supposition that changes in the anticipated returns to production factors influence the acquisition of these resources, and therefore capital and credit requirements, to a much greater degree than the cost of funds. Consequently, normal fluctuations in the cost of credit were considered a minor influence and omitted from consideration.

TRENDS IN FINANCING CAPITAL FUND REQUIREMENTS

Capital funds are required by the industry for three principal activities: 1. the transfer of farm real estate (land and buildings) from farm operators who are leaving, or reducing the size of their farm operations to farmers who are new or increasing the size of their operations, 2. non-real estate farm investment (farm machinery and equipment, and livestock and poultry purchases, and land improvements such as clearing, drainage, fencing, etc.) for expansion and replacement purposes, and 3. operating expenses (purchases of fuel, seed, fertilizer, chemicals, etc.). The capital funds required for these wide-ranging activities are financed by a combination of internal financing (from the farmer's cash flow) and external financing (farm credit) from various sources.

Financing Farm Real Estate Capital Transfers

One requirement for funds by farm operators results from farm ownership transfers which occur when existing farmers expand the size of their farms and new farmers enter the industry. Estimates of the value of real estate capital transferred were based on Agriculture Census data. The estimation procedure is described in the appendix. The total value of farm real estate capital transferred in 1971 was estimated at $789.0 million, of which $495.5 million was transferred to new farm operators and $293.5 million to expanding farm operators.[3] In 1976 the total value was $2,579.7 million, of which $1,456 million was transferred to new farm operators and $1,123.7 million to expanding farm operators (Table 1).

The amount of credit used for acquiring farm real estate capital increased from $493.7 million in 1971 to $1,384.1 million in 1976, but it decreased as a proportion of the total value of acquisition from 62.5 to 53.7 percent (Table 1). This decrease may be largely attributed to increases in farm income. Of the borrowed funds, about 50 percent was long-term credit to be repaid over 10 years or more, about 40 percent was intermediate-term credit to be repaid in terms ranging from 18 months to 10 years, and about 10 percent was short-term credit to be repaid in 18 months or less.

[3]"New farm operators" and "expanding farm operators" are defined in the appendix.

Financing Non-Real Estate Capital Purchases

The value of non-real estate capital purchases increased nearly fourfold from $527.8 million in 1971 to $1,983.9 million in 1976 (Table 1). Purchases of farm machinery and equipment (both new and used) accounted for approximately 90 percent of the total value of non-real estate capital purchased during the period.

The amount of credit used to finance their purchases also increased significantly, from $431.3 million in 1971 to $1,291.5 million in 1976 (Table 1). On the average, farm operators financed 39 percent of estimated non-real estate capital purchases with internal funds and borrowed the remaining 61 percent. The amount of external funds used for the acquisition of non-real estate capital was inversely related to the level of farm income. In the low farm income year of 1971, borrowed funds accounted for 81.7 percent of the total value of non-real estate capital purchases. Borrowed funds accounted for only 49.6 and 48.4 percent of total non-real estate capital purchases in the high farm income years of 1974 and 1975. It was estimated that about 22 percent of the total borrowed funds was short-term credit, about 76 percent intermediate-term credit, and about 1 percent long-term credit.

Financing Farm Operating Expenses

Total farm operating expenses increased from $2,978.8 million in 1971 to $6,169.5 million in 1976, an increase of about 107 percent (Table 1). Of the categories studied, machinery expenses (fuel, oil, tires, etc.) and commercial feed were the largest operating expense items and increased at the fastest rate.[4] Increased expenditures on non-capital inputs resulted from the continued increase in the use of purchased inputs in modern production techniques and higher input prices.

On the average, farm operators financed 45.7 percent of their total farm operating expenses with internal funds and 54.3 percent with borrowed funds during the 1971-76 period (Table 1). The use of borrowed funds for farm operating expenses was inversely related to the level of farm income, as was the case in the financing of non-real estate capital purchases. In the low farm income years of 1971 and 1972, credit supported about 57.6 percent of the total farm operating expenses while in the high farm income year of 1974, credit accounted for only about

[4]Based on data obtained from R. Daviault, *Selected Agricultural Statistics for Canada*, Publication No. 77/10, Information Services, Agriculture Canada, Ottawa, June 1977.

TABLE 1. TRENDS IN FINANCING CAPITAL FUND REQUIREMENTS IN CANADA, 1971-76

Requirements	1971	1972	1973	1974	1975	1976
			millions of dollars			
Capital Requirements for						
Real Estate Transfers[a]	789.0	–[d]	–	–	–	2,579.7
Non-Real Estate Investment[b]	527.8	746.2	914.2	1,560.3	2,047.6	1,983.9
Operating Expenses[c]	2,978.8	3,204.6	4,022.9	4,949.6	5,578.4	6,169.5
Total Capital Required	4,295.6	–	–	–	5,578.4	10,733.1
Credit Requirements for						
Real Estate Transfers	493.7	567.2	854.2	1,118.2	1,225.4	1,384.1
Non-Real Estate Investment	431.3	570.2	685.4	774.1	990.5	1,291.5
Operating Expenses	1,715.7	1,838.4	2,063.1	2,383.9	3,261.7	3,341.4
Total Credit Requirements	2,640.7	2,975.8	3,602.7	4,276.2	5,477.6	6,017.0
Internal Funds Used for						
Real Estate Transfers	295.7	–	–	–	–	1,195.6
Non-Real Estate Investment	96.5	176.–	228.8	786.2	1,057.1	592.4
Operating Expenses	1,263.1	1,366.2	1,959.6	2,565.7	2,316.7	2,828.1
Total Internal Funds Used	1,655.3	–	–	–	–	4,616.1
			percent			
Ratio of Credit Used to Capital Requirements						
Real Estate Transfers	62.5	–	–	–	–	53.7
Non-Real Estate Investment	81.7	76.4	75.0	49.6	48.4	65.1
Operating Expenses	57.6	57.4	51.3	48.2	58.5	54.2
Total	61.5	–	–	–	–	56.1

[a] Includes the value of land and buildings transferred to new and expanding farm operators, obtained from Agriculture Census Match data.

[b] Includes total purchases of new and used farm machinery and equipment as well as the purchases of livestock and poultry. The value of new machinery and equipment purchased was obtained from Agriculture Canada, *Statistics Relating to Farm Machinery in Canada, 1950 to 1976,* Agriculture Canada Publication No. 78/4, July 1977. The value of used farm machinery and equipment purchased was estimated on the basis of farm machinery depreciation obtained from the same publication. The value of livestock and poultry purchased was obtained from R. Daviault, *Selected Agricultural Statistics for Canada,* Publication No. 77/10, Agriculture Canada, June 1977.

[c] Includes total operating expenses obtained from Agriculture Canada Publication No. 77/10.

[d] (–) denotes relevant data that are not available.

48.2 percent. The 1969-71 wheat surplus followed by large sales in 1973 and 1974 were likely major influences in the amount of credit used for farm operating expenses. The borrowed funds were primarily short-term credit.

METHODS OF PROJECTING CREDIT REQUIREMENTS IN 1981

Future capital fund requirements in agriculture will be primarily determined by the future performance of the Canadian economy in general and of the farm industry in particular. Because it is difficult to predict what conditions will prevail to 1981, low, moderate, and high credit requirement projections are provided. The low projections are based on the assumption that the general inflation rate and the rate of increase in farm income up to 1981 will be similar to the low rates observed for the 1961-66 period. The moderate projections are based on moderate general inflation rates and farm income increases as measured by the average increases for the 1961-76 period. The high projections are based on the assumption that the general inflation rate and the rate of increase in farm incomes will match the high rates observed in the 1971-76 period.

The forecasts of credit needs recognized the fact that farmers' ability to generate internal funds for capital requirements varies with income. A fixed ratio was not assumed as in past studies of this nature.[5] Further assumptions relating to projections of specific credit requirements are discussed in the following sections.

[5] See, for example, Emanual Melichar, "Aggregate Farm Capital and Credit Flows Since 1950, and Projections to 1980," *Agricultural Finance Review,* Vol. 33, July 1972, pp. 1-7.

Projections of Credit Required for Farm Real Estate Transfers

Capital Fund Requirements

The amount of capital funds required for future farm real estate transfers was determined using the number of transfers, the average volume of real estate capital transferred, and the prices of farm real estate.

The future number of farm transfers and the associated capital requirements will be influenced by many socio-economic factors such as the level of farm income, age composition of farm operators, off-farm employment opportunities, etc. The Markov chain analysis technique was used to project farm transfer activity. This approach directly estimates the number of farm transfers resulting from a combination of these factors through a transition probabilities matrix without identifying the separate impact of each factor.[6]

The projection procedure required two elements: the transition probabilities matrix along with an appropriate base distribution of farm operators classified by the size of farm in acres of owned land, and the potential entrants for the projection period. The observed transition probabilities matrices for 1966-71 and 1971-76 were different because of the different socio-economic influences of each period. Future structural change (i.e., the projected transition probabilities matrix of the projection period) will be influenced by the future performance of the farm industry and the economy in general.

Derivation of the transition probabilities matrix for the 1976-81 period was based on the assumption that future economic conditions would be better than those during 1966-71, but less favorable than those during 1971-76. Observations for 1976 and 1978 tend to support this assumption. Consequently, it was assumed that the 1976-81 transition probabilities matrix would approximate the average of the 1966-71 and the 1971-76 transition probabilities matrices.

A proxy for the number of potential new entrants was needed both for the derivation of transition probabilities and for the forecasting procedure. The estimate had to be selected carefully since the number of potential entrants to an industry has a definite and measurable effect on subsequent projections of entrants and exits when using a Markov chain approach.[7]

The total agricultural labor force in Canada was assumed to represent the potential new entrants in 1966 (the estimate was 551,000). This estimate was then used to calculate the 1966-71 transition probabilities of new entrants and the probability that these potential entrants would remain outside the farm industry. Those who entered in the 1966-71 period were no longer potential entrants in the next period, while exiting farm operators became potential entrants for the next period. Consequently, the number of potential entrants in 1971 equalled the potential entrants in 1966 plus exiting farm operators minus new entrants.[8] This procedure was extended to determine the potential entrants for 1976.

Given the estimated transition probability matrix for the 1976-81 period and the vector of farm operators and potential new entrants in the base year (1976), the numbers of farm operators, new entrants, and exiting farm operators by size class for the projection period were estimated as the product of the matrix and the vector. The number of farm transfers was then calculated as the sum of the number of new operators and the number of continuing operators that expanded their farm size (in terms of owned farmland). The number of transfers in 1981 was assumed equal to the average annual number of transfers forecast for the 1976-81 period.

Two steps were required in the projection of capital requirements for the transfer of real estate ownership. The first was to project the total amount of farmland that would be transferred to either new or expanding farm operators. This was derived by summing across farm size classes the product of the average acres of farmland per transfer and the number of transfers. The change in average acres of farmland per transfer between 1966-71 and 1971-76 was found to vary by size class. It was assumed that the change in average size of transfer between 1976 and 1981, for each size class, would follow the trend established between the two earlier

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[6]Each cell in the transition probabilities matrix represents the probability of a farm operator (or potential farm operator) having a specific farm size at the end of the period, given the farm size at the beginning of the period.

[7]Stanton, B.F. and L. Kettunen, "Potential Entrants and Projections in Markov Process Analysis," *Journal of Farm Economics*, Vol. 49 (3), August 1967, pp. 633-643.

[8]This approach was tested for Canada for the period 1971-76, and the results indicated that forecast errors were less than 1 percent when compared with the actual number of farm operators reported in the 1976 Census of Agriculture. It should be noted, however, that this approach would not be reliable at the provincial level since exiting farm operators might migrate out of the province and consequently may not be potential entrants in the subsequent period.

periods. Total farmland acreage to be transferred was then calculated as the product of the estimated average size of transfer and the projected number of transfers to both new and expanding farm operators.

The value of land and buildings per acre is expected to increase during the 1976-81 period because of inflation and increases in land productivity. It is assumed that the annual growth rate in land productivity for 1976-81 will account for a moderate 3-percent increase in land prices as observed in the 1961-76 period. Inflation is less stable than productivity gains and thus less predictable. Three inflation rates were determined by examining the three different inflation periods; 1 percent in 1966-71 (low), 5 percent in 1966-76 (moderate), and 10 percent in 1971-76 (high). The estimates of the value of land and buildings per acre were therefore calculated using low (4 percent), moderate (8 percent), and high (13 percent) annual compound inflation rates.

Credit Requirements

As indicated in Table 1, the proportion of credit used to finance real estate transfers declined from 62.5 percent in 1971 to 53.7 percent in 1976. As the farm industry's economic conditions in 1981 are expected to be less favorable than those in the 1973-76 period, but more favorable than in the earlier 1970s, the average ratio of credit used to capital required between 1971 and 1976 (55.7 percent) was used to forecast the credit needs from the three estimates of the value of real estate transfers in 1981.

Projections of Credit Required for Non-Real Estate Capital Investment

Capital Fund Requirements

Funds required for non-real estate capital investment in 1981 will be determined by future changes in the quantities and prices of the items used. These changes are influenced by a large number of interrelated factors such as farm income, relative input prices, product prices, structural change in the industry, etc.[9] To identify and measure these factors would be a study in itself. The simplest and most direct method of forecasting non-real estate investment was to identify one such factor that was highly correlated with, and had a relatively constant ratio to, investment.

The level of farm income was found to be highly correlated with non-real estate investment and the ratio of farm income to investment has remained fairly constant at an average 40.4 percent throughout the 1970s. Three levels of non-real estate investment were estimated using this ratio and the three net farm income estimates. Net farm income in 1981 was estimated under three levels of input usage, input prices, and output prices (Table 2).

Credit Requirements

The data in Table 1 indicated that credit used for non-real estate investment is inversely related to the level of farm income. Future demand for credit for non-real estate investment should therefore reflect variations in the level of farm income. Accordingly, 81.7 percent of projected non-real estate capital requirements was used to forecast the credit requirements for the low inflation-low farm income case while 48.4 percent was used for the high inflation-high farm income situation. For the moderate case, the ratio of 61 percent was used. These ratios were derived in Table 1.

Projections of Credit Required for Acquisition of Non-Capital Inputs

Capital Fund Requirements

Funds required for the acquisition of non-capital inputs in 1981 will be determined by future increases in the use of such inputs and the associated price changes which in turn will be influenced by the prospects of the farm industry and the supply-demand conditions of the farm input markets. The increase in the use of non-capital inputs in real terms was fairly constant over the 1961-76 period at an annual compound growth rate of 3.9 percent.[10] This rate was used to estimate the quantity of non-capital inputs to be used in 1981.

Price levels of non-capital inputs are not expected to remain as stable as the physical quantity. In the high inflation period (1971-76), overall farm input prices increased at an annual growth rate of 9.7 percent, compared with a rate of only 3.7 percent in the low inflation period (1961-66). During 1961-76, farm input

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[9] Fujitani, Kazuo, "An Empirical Analysis of Farm Machinery Investment of Canada: 1960-1974," unpublished Master's practicum, Natural Resource Institute, University of Manitoba, 1977.

[10] Tung, F.L. and W.D. Jones, "An Overview of Productivity Change in the Canadian Farm Industry, 1961 to 1976," unpublished mimeograph, February 1978.

TABLE 2. ESTIMATED NET FARM INCOME IN 1981, CANADA

Alternative Projections	Gross Farm Income 1976	Estimated Gross Farm Income 1981[a]	Operating and Depreciation Expenses 1976	Estimated Operating and Depreciation Expenses 1981[b]	Estimated Net Farm Income 1981[c]
			millions of dollars		
Low	11,390	14,196	7,277	10,399	3,797
Moderate	11,390	16,353	7,277	11,248	5,105
High	11,390	22,614	7,277	13,766	8,848

[a]Estimated in terms of compound growth rates over the five-year period (1976-81) which were determined by a constant annual physical output growth rate of 1.7 percent (1961-76 period), plus a 2.8-percent annual inflation rate in farm product prices (farm product price index 1961-66) for low growth rate, a 5.8-percent annual inflation rate (farm product price index 1971-76) for moderate growth rate, and a 13-percent annual growth rate (farm product price index 1971-76) for high growth rate.

[b]Estimated in terms of compound growth rates which were calculated in terms of a constant long-term growth rate in the use of non-capital inputs of 3.9 percent, plus a 3.5-percent annual growth in farm input prices (farm input price index 1961-66) for low growth rate, a 5.2-percent annual growth rate (farm input price index 1961-76) for moderate growth rate, and a 9.7-percent annual growth rate (farm input price index 1971-76) for high growth rate.

[c]The difference between the estimated 1981 gross farm income and operating and depreciation expenses.

Sources: R. Daviault, *Selected Agricultural Statistics for Canada,* Publication No. 77/10, Agriculture Canada, June 1977.

Tung, F.L. and W.D. Jones, "An Overview of Productivity Change in the Canadian Farm Industry, 1961 to 1976," unpublished mimeograph, February 1978.

prices increased at an annual growth rate of 5.2 percent. This was regarded as the moderate inflation rate in farm input prices. The three inflation rates in farm input prices and the estimated increase in the use of these inputs formed the base of the three alternative forecasts of capital fund requirements for operating expenses (i.e., for the low inflation case the forecast was based on the estimated 3.9-percent increase in the use of intermediate inputs and the low inflation rate in input prices of 3.5 percent.)

Credit Requirements

The use of credit for operating expenses was found to be inversely related to the level of farm income (Table 1). This relationship was employed to forecast future credit needs from estimated operating expenses. The ratios used were 57.6 percent for the low, 54.3 percent for the moderate, and 48.2 percent for the high inflation-income cases.

RESULTS AND IMPLICATIONS

The forecasts of capital and credit requirements for 1981 are in Table 3. Estimates of total capital requirements range from $12,812.1 to $18,974.2 million while credit estimates range from $7,711.6 to $9,432.3 million. Based on moderate gains in farm income and a moderate inflation rate, the forecast of $8,093.5 million in farm credit represents an additional $2,076.5 million in credit extended over the estimated 1976 level. This moderate increase translates into a 6-percent annual increase compounded over the 1976-81 period which is much lower than the 1971-76 estimated compound annual increase of 18 percent.

The major farm credit requirements in 1981 will be for operating expenses which are projected to be in the $5,087.4 to $5,625.9 million range, compared with an estimated $3,341.4 in 1976. Farm transfer credit requirements are forecast to be in the range of $1,370.9 to $2,076.3 million. While the low estimate actually represents a decrease in credit use for farm transfers of $13.2 million from the 1976 level, the increase of $692.2 indicated by the high estimate is considered more likely to occur. Purchases of non-real estate capital are expected to require the least credit in 1981, the forecast being in the range of $1,253.3 to $1,730.1 million.

The forecast increases in farm capital and credit requirements have several implications for the agricultural industry. Beginning farmers will find it increasingly difficult to meet the loan equity requirements to purchase a viable sized farm and to fully amortize the debt over the life of the operator. As a result, a greater dependency on alternative means of financing, such as

the formation of farm corporations or tenant farming, may influence substantial changes in the industry's structure.

TABLE 3. FORECASTS OF CAPITAL AND CREDIT REQUIREMENTS FOR 1981, CANADA

Requirement	1981 Low	1981 Moderate	1981 High
	millions of dollars		
Forecasted Capital Requirements for			
Real Estate Transfers	2,461.3	2,974.5	3,727.7
Non-Real Estate Investment	1,534.0	2,062.2	3,574.5
Operating Expenses	8,816.8	9,537.4	11,672.0
Total Capital Requirements	12,812.1	14,574.1	18,974.2
	percent		
Ratio of Credit Used to Acquire Capital Requirements			
Real Estate Transfers	55.7	55.7	55.7
Non-Real Estate Investment	81.7	61.0	48.4
Operating Expenses	57.6	54.3	48.2
Total	60.1	55.6	49.7
	millions of dollars		
Forecasted Credit Requirements for			
Real Estate Transfers	1,370.9	1,656.8	2,076.3
Non-Real Estate Investment	1,253.3	1,257.9	1,730.1
Operating Expenses	5,087.4	5,178.8	5,625.9
Total Credit Requirements	7,711.6	8,093.5	9,432.3

As the capital requirements in farming increase, the industry's annual cost of using this capital (i.e., interest on debt, depreciation, etc.) increases accordingly and is reflected in higher production costs. Increasing production costs could have an impact of varying magnitudes on farm incomes, the industry's competitive market position (both export and domestic), and on consumer welfare (higher food prices). To the extent that increased capital requirements reflect farm expansion, increased production costs could be at least partially offset by productivity gains achieved through economies of size.

A further concern is whether or not sufficient farm credit will be available in 1981 at a reasonable cost for the appropriate length of term. An adequate supply of short-term and intermediate-term credit for the acquisition of non-real estate capital and operating expenditures should be available if the forecast requirements are reasonably correct and if current growth rates in credit extended of this type continue. Supplies of long-term credit are less certain. Increases in the availability of public funds from provincial and federal sources for farm credit may be restricted in view of the expected scale and priority of other activities competing for public funds, such as resource development and social welfare programs. Commercial lending institutions are expected to provide an increasing amount of long-term credit but there is still a reluctance to accept the reduced liquidity and the perceived risks of this market. Thus farmers with the greatest need for long-term credit, those with low equity or security, may find it increasingly difficult to obtain credit from commercial sources. A lack of credit would constrain the current direction of agricultural development.

APPENDIX

ESTIMATION OF REAL ESTATE VALUE TRANSFERRED, 1971 AND 1976

Funds are required for transfers of farm real estate capital, including land and buildings, to new farm operators and those expanding their farms. Estimates of the funds required for farm transfers were derived from the 1966-71 and 1971-76 Agriculture Census Match data obtained from Statistics Canada. The reliability of the estimates is limited by the quality of the matches.[1] Given the quality of the data, the estimation procedure consisted of two steps. The first determined the number of farms being transferred every year. This was done by matching all farm operators for two periods: 1966-71 and 1971-76. The number of new farm operators entering farming either through inheritance or purchase, was assumed to be equal to the number of unmatched farm operators at the end of the match period.[2] The number of expanding farm operators was assumed to be equal to the number of continuing farm operators (matched farm operators) who, over the matching period, increased their acres of owned farmland. Each entrant and operator expanding his farm was therefore considered to represent a farm transfer. All farms were grouped into 13 size classes according to the acres of farmland owned at the beginning and end of a given five-year period.

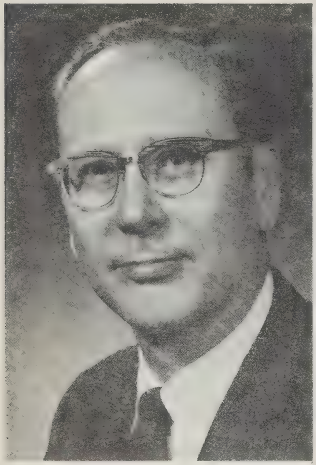
The total value of real estate associated with these farm transfers was then obtained indirectly from the match data according to the following adjustment procedure. The total value of real estate transferred was adjusted to include only the *owned* portion of farmland and buildings since the transfer of rented real estate does not require capital. Ratios of owned farmland acreages to total farmland acreages were used to calculate the value of owned real estate transferred, since the total value of land and buildings could not be segregated between owned land and rented land.[3] The value of real estate capital transferred for 1971 was assumed equal to the average annual value of transfers between 1966 and 1971. The same procedure was used to estimate the value of real estate transfer for 1976.

[1] The quality of the 1966-71 match is quite good. For example, error in the match for Saskatchewan is about 6 percent. The 1971-76 match had not undergone a quality check at the time this study was carried out. For more details see Bollman, R.D., "1966-1971 Census of Agriculture Match: Methodology and Analysis of the Quality of the Match," unpublished paper, Agriculture Division, Statistics Canada, 1977.

[2] Conceptually, farm transfers through inheritance may not require capital funds. In practice, however, this type of farm transfer is not very common. The majority of father-son farm transfers involve financial arrangements. Consequently, both types of farm transfers are included in this study.

[3] It is recognized that this assumption might have resulted in underestimating the value of owned real estate capital transferred since rented land is often inferior land which has a lower value. However, sufficient, reliable information was not available to allow consideration of this difference in the present study.

ENERGY USE IN THE CANADIAN HORTICULTURAL CROP AND FOOD SYSTEM



This paper assesses all forms of energy use in the Canadian horticultural system - production, processing, distribution, and consumption - in terms of the current situation and the short-term outlook for alternatives. The paper presents a general overview of energy use in the food system and then examines the horticultural sector in more detail. The analysis draws largely upon existing analytical studies and data sources. For purposes of this paper, the horticultural sector includes domestic fruits and vegetables, including potatoes and sugarbeets.

*I.F. Furniss**

INTRODUCTION

The current interest in energy consumption in the horticultural crop and food system, even though energy is only one input among many, including land, buildings, labor, and machinery, is probably due to three principal reasons. First, by far the most common final form of energy consumed in Canada is liquid fossil fuels. In 1976, liquid fuels accounted for 54 percent of total energy consumption (Figure 1). Since 1973, just before the large petroleum price increases of 1974, liquid fossil fuels consumed in Canada have decreased slightly in relative terms while natural gas and electricity have increased somewhat in importance. Even so, total consumption of liquid fossil fuels was 3 percent greater in 1976 than in 1973. The increases for natural gas and electricity in the same period were 10 and 14 percent. Coal and coke consumption, however, decreased 13 percent.

By economic sector, industry was the largest energy consumer in 1976 with 29 percent of the total, followed by transportation at 26 percent (Figure 2). Primary agriculture accounted for about 3 percent of all energy consumed. However, the increase in consumption in primary agriculture (16 percent) in the three-year period 1973-76 was the largest of the sectors given, followed by a 10-percent increase for transportation.

A second reason for the interest in energy consumption is the finiteness of low-cost sources of petroleum fuels, both in Canada and abroad. Since 1947, Canada has gone from a country which imported 90 percent of its petroleum requirements, to one which was nearly self-sufficient in 1968, after balancing off imports and exports, to again a large petroleum importer by 1975. In the absence of new, large discoveries or a substantial cutback in consumption (or both), Canada's dependence on foreign supplies is expected to increase. Assuming a straight-line growth in demand, by 1985 the shortfall between Canadian production and consumption is projected at 900,000 barrels a day. If the assumed price is \$20 a barrel for imported crude, the resulting oil trade deficit could exceed \$6 billion a year by 1985 (Energy, Mines and Resources Canada, 1978).

A third reason is the rapid escalation in world crude oil prices, initiated by the Organization of Petroleum Exporting Countries (OPEC) in 1973, after recognizing that they had an increasingly scarce resource in strong

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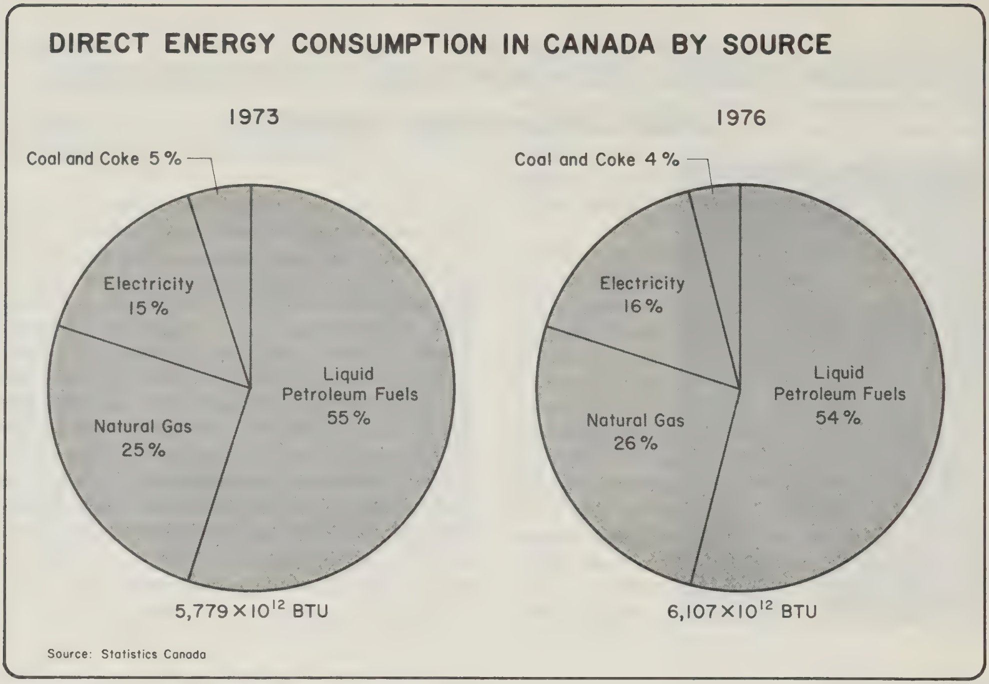

Figure 1

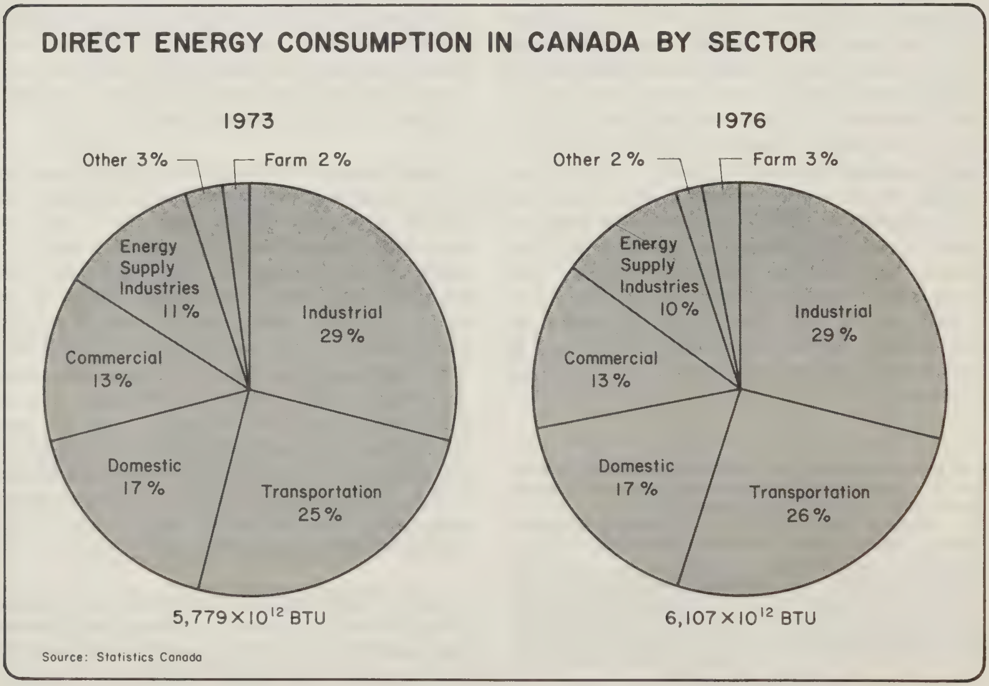

Figure 2

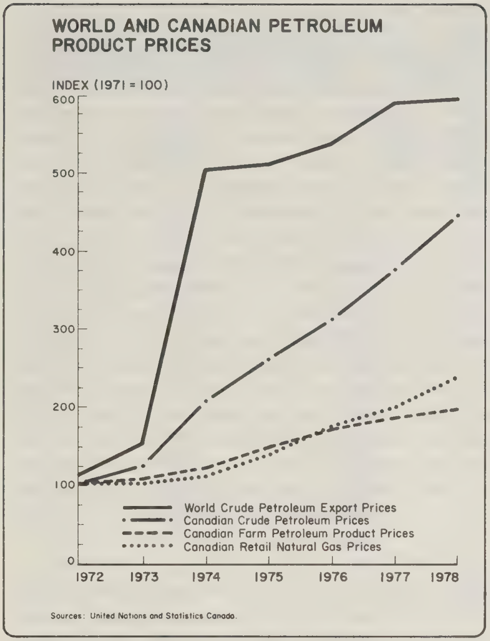

Figure 3

demand at pre-1973 prices. World crude petroleum export prices increased more than fourfold from 1972 to 1974 (Figure 3). By the end of 1977, world prices were over five times their 1972 levels. To alleviate such disruptive changes in world prices, the Canadian federal and provincial governments introduced policies to gradually move domestic crude oil prices to world levels. Still, Canadian crude oil prices more than tripled from 1972 to 1977. Farm prices of gasoline and diesel fuels almost doubled in this period. Natural gas prices, which have been tied to crude oil prices in Canada since 1975, have increased proportionately. At the same time, increases in fuel prices have generally been greater than the increases in farmers' product prices. The impact of higher energy prices in relation to farm prices has been more severe for horticultural food crop production than for other types of farm production; hence, the industry faces a severe cost-price squeeze. Being an industry that was based on relatively low-cost energy prior to 1974, adjustment problems have become acute, particularly with the lack of low-cost liquid fuel alternatives.[1]

THE FOOD SYSTEM

The primary agricultural sector consumes relatively little of the economy's direct energy supply, about equal to agriculture's share of the Gross National Product. But primary agriculture accounts for 18 percent of the total food system's energy consumption in both direct and indirect forms (Figure 4). This is the smallest proportion of the total energy input in the food system of any major subsector. Processing and packaging account for the largest proportion (32 percent), followed by home preparation (30 percent), and transportation and distribution (20 percent). These relationships are typical of an industrialized, largely urban society with a highly developed and efficient primary agriculture. While any one part of the food system, however, is a relatively small user of energy in the economy as a whole, the total food system accounts for almost one quarter of total Canadian energy consumption in direct and indirect forms.[2]

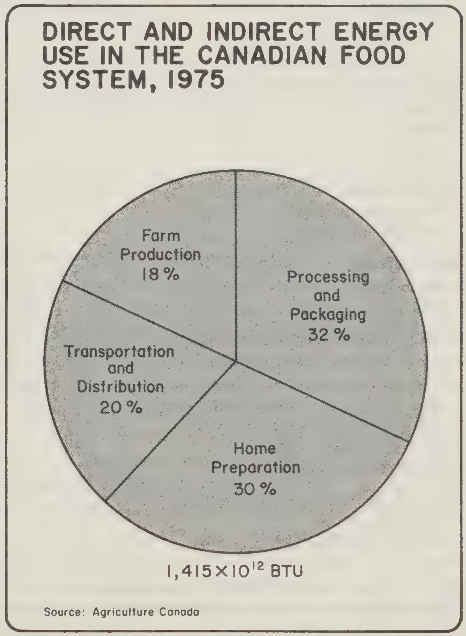

Figure 4

[1]The effects on society of changes in energy use cannot be evaluated solely in terms of the energy content of the inputs and outputs. Allocating resources to reduce dependence on liquid fossil fuels according to energy content may reduce our consumption of these fuels but at the cost of severe social and economic disruptions (Huettner; Doering, *et al.*; and Edwards).

[2]The indirect energy consumption in the food system includes the fossil fuel and electrical energy used to produce farm inputs such as fertilizers and pesticides, and the energy embodied in all production and processing machinery and packaging materials. The food system also includes the energy used for the transportation and distribution of farm inputs and farm and food products.

TABLE 1. ENERGY INPUTS AND ENERGY OUTPUT-INPUT RATIOS FOR SELECTED CROPS AND LIVESTOCK PRODUCTS, ONTARIO (1976) AND ALBERTA (1975), IN ORDER OF DECREASING RATIOS

Province and Commodity	Percent of Total Energy Input		Energy Output-Input Ratios[b]
	Fuel	Other[a]	
Ontario Vegetables (Per Acre)			
Carrots	43.2	56.8	3.78
Rutabagas (Turnips)	30.2	69.8	2.80
Pumpkins	18.4	81.6	2.64
Potatoes	27.8	72.2	2.20
Onions	19.2	80.8	2.12
Tomatoes (Hand Harvested)	8.6	91.4	1.72
Peas (Shelled)	43.4	56.6	1.64
Celery	22.6	77.4	1.48
Cabbage	19.4	80.6	1.42
Tomatoes (Machine Harvested)	21.1	78.9	1.38
Snapbeans (Green)	42.2	57.8	1.31
Sweet Corn (Machine Harvested for Processing)	16.2	83.8	1.20
Sweet Corn (Hand Harvested for Fresh)	11.4	88.6	0.79
Snapbeans (Yellow)	42.2	57.8	0.78
Cucumbers	37.5	62.5	0.76
Asparagus	12.1	87.9	0.07
Ontario Fruits[c] (Per Acre)			
Apples	20.4	79.6	2.07
Pears	18.9	81.1	1.56
Plums	22.1	77.9	1.49
Peaches	30.5	69.5	1.12
Grapes	22.4	77.6	0.78
Cherries (Sour)	39.8	60.2	0.73
Strawberries (8 Crops)	31.4	68.6	0.52
Raspberries (8 Crops)	31.5	68.5	0.34
Ontario Cereals (Per Acre)			
Winter Wheat	22.0	78.0	3.77 (7.30)
Grain Corn	33.6	66.4	3.11 (5.81)
Alberta Cereals and Oilseeds (Per Acre)			
Barley on Stubble (Three Hills)	35.7	64.3	7.03
Wheat on Summerfallow (Three Hills)	33.1	66.9	6.35
Wheat on Summerfallow (Acadia Valley)	47.8	52.2	5.61
Rapeseed on Summerfallow (Olds)	54.0	46.0	4.95
Barley on Stubble (Olds)	24.5	75.5	3.96
Oats on Stubble (Olds)	25.4	74.6	3.86
Ontario Livestock Products[d] (Per Cow)			
Milk (5 3/4 Years)	27.2	72.8	0.51 (0.94)
Beef (5 Lactations)	10.1	89.9	0.21 (1.15)

[a] Indirect energy consumption in the forms of fertilizers, pesticides, machinery, etc.

[b] Ratios shown in parentheses include the energy value of straw, fodder, and manure produced.

[c] Tree fruits do not include establishment energy but berries do.

[d] Includes electrical energy.

Sources: P.H. Southwell and T.M. Rothwell, *Report on Analysis of Output-Input Energy Ratios of Food Production in Ontario*, School of Engineering, University of Guelph, March 1977, Contract No. OSW76-00048 with Agriculture Canada, Ottawa.

N.E. Jensen and B.T. Stephanson, *Energy Budgets for Crops in Western Canada*, Department of Agricultural Engineering, University of Alberta, January 1975, contract with Agriculture Canada, Ottawa.

Estimated energy output-input ratios and the distribution of energy consumed in the production of selected crop and livestock products are given in Table 1. These figures indicate that horticultural crops (and also livestock) are relatively inefficient converters of fossil energy to food. Some horticultural crops, however, compare favorably with those cereal crops grown in the same region, e.g., carrots. The horticultural crops which include soft fruits and sweet corn are among the most inefficient energy users. Thus, on an *energy criterion* alone, cereal crops would be given top priority in any energy allocation scheme.[3] But crops such as potatoes, fruits, and vegetables are not necessarily competitive with cereal crops in land use. The production of horticultural crops generally represents the highest economic land use for agriculture in areas where they are grown. Since 1971, however, the relative growth in output of horticultural crops in Canada has been modest: 2.4 percent a year for potatoes, 2.9 percent for vegetables, and 0.5 percent for fruit, indicating a stable or declining demand for domestic production.

Just how small a part of total agricultural production costs direct fossil energy inputs play is shown by the data in Table 2 for the total Canadian primary agricultural production sector from 1970-77 (the period when petroleum product prices were relatively inexpensive to the years in which prices increased sharply). For Canada as a whole, expenditures on petroleum products accounted for 9.0 percent of farm operating expenses in both 1970-72 and 1975-77, despite the 5.6-fold increase in world crude oil petroleum prices between the same two periods and the 1.7-fold in Canadian farm petroleum product prices. Expenditures on petroleum products by farmers in 1975-77 represented a smaller proportion of cash receipts (5.4 percent) than in 1970-72 (5.7 percent). The impact of higher fuel prices, however, has varied by region and by type of farming. Fuel expenditures represented an increased proportion of farm expenses in 1975-77 in Prince Edward Island, New Brunswick, Ontario, Saskatchewan, and British Columbia. In Nova Scotia and Quebec no change occurred. In Manitoba and Alberta, fuel expenses decreased as a percentage of total expenses. In all three Prairie Provinces, fuel expenses decreased as a share of cash receipts. What these figures indicate, therefore, is that the higher energy prices since 1974 have had the greatest impact on the expense side in those regions with significant horticultural crop production.

[3] Fruits and vegetables can provide essential dietary requirements for minerals, vitamins, and fiber which are not necessarily reflected in a total energy conversion calculation.

Although there has been an overall increase of 10.2 percent a year in the price index of farm-used petroleum products since 1971, the rate of increase for some fuels has averaged higher than this (Table 3). Fuel prices, according to various price indexes, increased 11.5 percent a year for diesel fuel, 13.7 percent for natural gas, 15.7 for light fuel oils, and 24.4 percent for heavy fuel oils. By comparison, the overall increase in the total Farm Input Price Index was 10.2 percent a year, while the average annual increase in the Consumer Price Index has been 8.4 percent since 1971. The fuels favored by the horticultural industry for heating, such as natural gas and fuel oils, have therefore shown more rapid price increases than the principal fuels used in other types of farming. These price increases have also been generally greater than the increases since 1971 in prices of horticultural crops: 3.1 percent a year for potatoes, 12.2 percent for vegetables, and 8.1 for fruits.[4] Hence, higher energy prices and costs have more severely affected horticultural production than other types of farming.

THE HORTICULTURAL FOOD CROP SYSTEM

Production

As noted previously, expenditures on fossil fuels are a relatively small portion of total farm operating expenses. Table 4 presents similar data to those given earlier in Table 2 but for individual farm businesses by province and value of sales for three types of horticultural crop farms in 1974. (Data for more recent years are not available.) The data in Table 2, however, provide an indication of trends which should be indicative for the more specific cases. Also, the data in Table 4, being averages of individual taxfiler data, include inter-farm sales and purchases while those in Table 2, being aggregates for a province as a whole, do not. While these differences affect the level of the averages, they do not affect proportions to the same extent. Again, the data in Table 4 indicate that farm expenses for fossil fuels on horticultural food-crop farms were a relatively small proportion, even in 1974, of total farm operating expenses. And the share of total expenses that fuel comprises is smaller for the larger-size farms regardless of region or type.

[4] Based on weighted average farm values.

TABLE 2. EXPENDITURES ON PETROLEUM PRODUCTS AS A PERCENTAGE OF FARM CASH RECEIPTS AND OPERATING EXPENSES, ALL FARMS, CANADA AND PROVINCES, 1970-77

Province and Item	1970	1971	1972	1973	1974	1975	1976	1977	Averages 1970-72	Averages 1975-77
					percent of total					
Prince Edward Island										
Cash Receipts	4.4	5.1	4.4	4.1	3.5	4.8	4.8	5.6	4.6	5.1
Operating Expenses	6.7	6.4	6.1	7.7	6.0	7.1	8.5	8.2	6.4	7.9
Nova Scotia										
Cash Receipts	2.9	4.6	4.0	3.1	2.9	3.4	4.1	3.9	3.8	3.8
Operating Expenses	4.2	6.1	5.8	4.6	3.8	4.6	5.6	5.7	5.4	5.3
New Brunswick										
Cash Receipts	5.2	5.7	4.6	4.2	4.8	5.0	5.3	6.4	5.2	5.6
Operating Expenses	8.1	8.1	7.5	8.2	8.3	7.5	8.7	9.7	7.9	8.6
Quebec										
Cash Receipts	3.6	3.8	3.7	3.7	3.5	3.3	3.7	4.0	3.7	3.7
Operating Expenses	5.3	5.4	5.6	5.5	4.9	4.9	5.3	5.7	5.4	5.3
Ontario										
Cash Receipts	4.7	4.8	4.3	4.1	4.1	4.3	4.8	5.3	4.6	4.8
Operating Expenses	6.7	6.7	6.4	5.9	6.4	6.4	7.1	7.5	6.6	7.0
Manitoba										
Cash Receipts	8.3	8.2	6.4	5.5	5.4	5.4	6.6	7.0	7.6	6.3
Operating Expenses	13.3	13.2	12.4	11.0	11.2	10.7	11.3	11.5	13.0	11.2
Saskatchewan										
Cash Receipts	9.6	7.6	6.2	5.5	5.0	4.9	6.5	8.0	7.8	6.5
Operating Expenses	15.1	14.3	14.4	12.7	12.8	13.6	14.6	16.6	14.6	14.9
Alberta										
Cash Receipts	7.9	7.5	6.6	5.8	4.8	5.2	6.5	6.5	7.3	6.1
Operating Expenses	12.3	12.0	11.6	10.4	9.6	9.8	10.9	11.4	12.0	10.7
British Columbia										
Cash Receipts	4.2	4.5	4.4	3.6	4.1	4.4	4.6	5.0	4.4	4.7
Operating Expenses	5.8	6.1	6.1	5.3	5.6	6.0	6.4	7.1	6.0	6.5
Canada										
Cash Receipts	6.1	5.9	5.2	4.6	4.5	4.6	5.5	6.0	5.7	5.4
Operating Expenses	9.1	9.0	8.8	7.9	8.1	8.3	9.1	9.7	9.0	9.0
					1970 = 100					
World Crude Petroleum Prices	100	127	143	196	641	651	681	748	123	693
Canadian Farm Petroleum Product Prices	100	103	105	112	128	154	177	192	103	174

Sources: Statistics Canada, *Farm Net Income*, Cat. No. 21-202 Annual.
United Nations, *Monthly Bulletin of Statistics*, Table 59.
Statistics Canada, *Farm Input Price Index*, Cat. No. 62-004 Quarterly.

It was possible to compare the fuel shares of farm costs for all three types of farms only in Ontario and Quebec. In both provinces fuel accounted for a greater share of farm expenses on vegetable farms, followed by fruit farms. Potatoes had the smallest proportion in Quebec. In Ontario, fruit and potato farms were equal in this respect. Thus, even within the horticultural production sector itself, changes in energy costs have a relatively greater impact for vegetable crop farms than for fruit or potato farms.

Irrigation requirements, particularly for pumping water, increases the energy requirements of field-grown horticultural crops. While the energy crop output (Btu) is also increased by irrigation, the increase is usually not sufficient to offset the higher energy input in Btu. Much of the yield of such crops is also in the form of water (moisture content). Table 5 shows the acreages of irrigated crop production in Canada for 1970-71, the most recent data available. While the area of irrigated farmland in Canada is a very small proportion of the total area of farms (0.6 percent), the areas of horticultural crops which are irrigated are a significant part of the total areas of horticultural crops grown. In 1970-71, more than 40 percent of the areas of sugarbeets, tobacco, and strawberries grown were irrigated. By province, the largest proportion of irrigated land, 3.8 percent, was in British Columbia. The average area of horticultural crops irrigated per farm in 1970 was 61 acres, with sugarbeets and potatoes having the largest average irrigated areas (Table 6). Thus even in 1970, irrigation was a significant energy input for horticultural crops grown under field conditions in Canada.

The higher energy prices since 1974, especially for oil and natural gas, have had a sharp impact on costs in the Canadian greenhouse industry, especially for hothouse vegetable producers. The impact is shown statistically in Table 7. Fuel costs per firm for vegetable and ornamental flower (including potted plants) producers increased 93 percent from 1973 to 1977; the increase for vegetable producers only was slightly higher at 95 percent. When fuel costs are related to sales, however, the impact of higher energy prices on the vegetable producers becomes more evident. Between 1973 and 1977, total sales per firm of the vegetable and ornamental flower producers as a group increased 43 percent while fuel costs per dollar of sales increased 48 percent. For vegetable producers, however, sales per firm decreased 25 percent and fuel costs per dollar of sales increased 164 percent. Even though hothouse vegetable prices increased sharply in the four years from 1973 to 1977, 34 percent for tomatoes and 78 percent for cucumbers, fuel prices rose much more in the same period: 97 percent for light fuel oil, 182 percent for heavy fuel oils, and 94 percent for natural gas.

Although fuel costs in horticultural food crop production generally represent a relatively small percentage of total operating expenses, fuel costs are a large component of total costs in vegetable greenhouse production.

TABLE 3. ANNUAL CHANGES IN INDEXES OF PETROLEUM PRODUCT PRICES, CANADA, 1971-72 TO 1977-78

Period	All Farm Petroleum Products Used	Gasoline	Diesel Fuel	Light Fuel Oil (#2)	Heavy Fuel Oil (#4 to 6)	Natural Gas	All Farm Inputs	Consumer Price Index (All Items)
				percent				
1971-72	2.0	1.3	2.4	6.2	−7.8	0.7	6.0	4.8
1972-73	6.1	5.2	7.2	15.6	26.8	1.7	19.3	7.6
1973-74	15.0	16.3	14.9	29.2	77.8	10.1	16.9	10.8
1974-75	19.6	21.0	23.0	13.6	12.0	20.8	9.9	10.8
1975-76	14.9	16.4	17.7	16.2	16.2	28.9	6.3	7.5
1976-77	8.8	9.3	9.8	15.4	22.0	13.2	4.1	8.0
1977-78[a]	5.4	6.3	6.2	14.0	15.1	18.8	9.6	9.0
Average 1971-78	10.2	10.5	11.5	15.7	24.4	13.7	10.2	8.4

[a] Unofficial or preliminary estimates.

Sources: Statistics Canada, *Farm Input Price Index (1971=100)*, Cat. No 62-004 Quarterly (Columns 1, 2, 3, and 7).
Statistics Canada, *Consumer Prices and Price Indexes (1971=100)*, Cat. No. 62-010 Quarterly (Columns 4, 6, and 8).
Statistics Canada, *Industry Price Indexes (1971=100)*, Cat. No. 62-011 Monthly (Column 5).

TABLE 4. EXPENDITURES ON PETROLEUM PRODUCTS AS PERCENTAGES OF FARM CASH RECEIPTS AND OPERATING EXPENSES, HORTICULTURAL CROP FARMS, CANADA, SELECTED PROVINCES, 1974

Province and Gross Value of Farm Sales of Farm Products	Vegetables[a]		Potatoes		Fruits	
	Receipts	Expenses	Receipts	Expenses	Receipts	Expenses
	percent of total					
Prince Edward Island						
$25,000-49,999	–[b]	–	4.3	5.5	–	–
$50,000 and Over	–	–	3.5	4.8	–	–
All Sizes	3.0	4.7	4.0	5.2	–	–
Nova Scotia						
All Sizes	–	–	–	–	6.0	6.1
New Brunswick						
$25,000-49,999	–	–	5.7	6.8	–	–
$50,000 and Over	–	–	4.4	5.8	–	–
All Sizes	–	–	5.1	6.4	–	–
Quebec						
All Sizes	8.1	8.3	4.9	5.4	7.1	6.9
Ontario						
$25,000-49,999	6.0	8.6	–	–	3.3	4.4
$50,000 and Over	2.9	4.0	–	–	2.6	3.5
All Sizes	4.4	6.0	3.6	4.4	3.5	4.4
Alberta						
$50,000 and Over	2.8	3.5	–	–	–	–
All Sizes	3.0	4.1	–	–	–	–
British Columbia						
$25,000-49,999	–	–	–	–	3.2	5.0
$50,000 and Over	–	–	–	–	2.6	3.6
All Sizes	4.8	5.3	–	–	4.2	5.3

[a] Excludes potatoes.
[b] (–) Sample size was too small.

Source: W. Darcovich and J. Gellner, Farm Budgets: Receipts, Expenses and Incomes by Type and Size of Farm, 1974, Working Paper, Economics Branch, Agriculture Canada, Ottawa, February 1978.

Notes: The percentages given represent the proportion that farm expenses for petroleum products (excluding natural gas) are of total farm cash receipts and cash operating expenses per farm.
Fuel and oil expenses for automobiles are the farm-share only. The total cost of fuel is net of any taxes that are rebated.
The data are derived from a sample of farm taxfiler returns.
To qualify on a horticultural crop farm, 51 percent or more of the gross sales of a farm had to be derived from the given source.
No specialized horticultural crop farms were identified in Manitoba and Saskatchewan.

One estimate places its share of fuel costs (both operating and fixed) at 17 percent (Anderson and Teeter). But as a share of operating costs only, fuel costs account for about 30 percent. Thus the impact of higher fuel prices (and costs) is much greater for the greenhouse industry than for the non-greenhouse sector of the horticultural production system.

Beyond the Farm Gate

Total energy consumption (direct and indirect) beyond the farm gate for the food system as a whole accounts for about 82 percent of the total energy consumed in the system (Figure 4). Similar estimates and Canadian data are not available for the horticultural crop subsystem, hence information largely from U.S. sources is used. For given processing and distribution systems employing comparable technology, however, differences in energy use should not be important. Differences could exist in costs, because of the size of market served, length of transportation hauls and any other factors attributable to a smaller total population and population density. But is is questionable, however, if an estimate for the horticultural crop system comparable to that for the total food system is possible, or if possible, meaningful.

TABLE 5. AREAS OF IRRIGATED AND NON-IRRIGATED CROPLAND, CANADA, BY CROP AND REGION, 1970-71

	Irrigated Area (1970)							Total	Irrigated
Crop	Atlantic Region	Quebec	Ontario	Prairie Region	British Columbia	Canada[b]	Percent of Total	Area in Farms[cd]	Area as Percent of Total
	acres						%	000 ac	%
Cereals and Oilseeds	540	19,565	2,460	223,758	5,953	252,276	24.1	52,752	.48
Sugarbeets	—	1,114	—	37,515	—	38,629	3.7	85	45.45
Potatoes	1,745	5,054	4,337	25,507	3,598	40,242	3.9	270	14.90
Tobacco	652	6,485	63,425	—	—	70,562	6.8	102	69.18
Tree Fruits	98	1,122	3,351	229	31,305	36,105	3.5	135	26.74
Strawberries	607	1,851	1,765	121	1,230	5,575	.5	13	42.88
Vegetables[a]	782	4,474	10,760	8,276	9,183	33,480	3.2	255	13.13
Tame Hay	785	41,211	4,041	204,208	116,923	367,168	35.3	12,360	2.97
Improved Pasture	308	8,324	1,530	79,593	28,473	118,228	11.4	10,225	1.16
Other Irrigated Land	142	3,695	7,803	42,933	24,322	78,895	7.6	n.a.[e]	n.a.
Total Area Irrigated	5,659	92,895	99,472	622,140	220,987	1,041,160	100.0		
					thousand acres				
Total Area in Farms[cd]	3,505	10,801	15,963	133,571	5,823	169,669		169,669	.61
					percent of total				
Area Irrigated	.16	.86	.62	.47	3.8	.61			

[a] Excluding potatoes.
[b] Including the Yukon and Northwest Territories.
[c] On June 1, 1971.
[d] All Canada, including the Yukon and Northwest Territories.
[e] Not available.

Source: Statistics Canada, *1971 Census of Canada*, Cat. No. 96-701, Vol. IV, Part 1, Tables 30, 34, 36, 37, and 48.

TABLE 6. DISTRIBUTION OF SELECTED IRRIGATED HORTICULTURAL CROPS, CANADA, BY AREA IRRIGATED, 1970

		Area Irrigated (Acres)						
Crop	Unit	Under 5	5-40	41-80	81-120	121-200	201 and Over	All
Sugarbeets	Ac	—	759	3,048	5,024	10,035	19,763	38,629
	No.[a]	—	44	113	139	219	240	755
	Ac/Farm	—	17.2	27.0	36.1	45.8	82.4	51.2
Potatoes	Ac	293	5,155	4,603	2,516	6,129	21,546	40,242
	No.	206	562	165	63	78	109	1,183
	Ac/Farm	1.4	9.2	27.9	39.9	78.6	197.7	34.0
Tree Fruits	Ac	1,732	24,204	5,292	1,866	1,513	1,498	36,105
	No.	809	1,936	137	32	19	11	2,944
	Ac/Farm	2.1	12.5	38.6	58.3	79.6	136.2	12.3
Strawberries	Ac	815	3,179	637	143	261	540	5,575
	No.	605	575	49	10	5	9	1,253
	Ac/Farm	1.4	5.5	13.0	14.3	52.2	60.0	4.4
Vegetables[b]	Ac	1,143	12,544	4,174	2,642	4,281	8,695	33,479
	No.	649	1,169	135	66	79	85	2,183
	Ac/Farm	1.8	10.7	30.9	40.0	54.2	102.3	15.3
All Irrigated Crops	Ac	6,300	165,651	142,469	115,393	195,553	415,794	1,041,160
	No.	2,743	8,486	2,439	1,149	1,237	1,110	17,164
	Ac/Farm	2.3	19.5	58.4	100.4	158.1	374.6	60.7

[a] Number of farms reporting irrigation.
[b] Excluding potatoes.

Source: Statistics Canada, *1971 Census of Canada,* Cat. No. 96-701, Vol. VI, Part 1, Table 60.

TABLE 7. SELECTED STATISTICAL INFORMATION ON THE CANADIAN GREENHOUSE INDUSTRY, 1973-77

Item	Unit	1973	1974	1975	1976	1977	Percent Changes, 1973-77
Vegetables and Ornamental Flowers							
Canada							
Firms Reporting	no.	1,252	1,253	1,268	1,381	1,678	34.0
Area of Glass and Plastic/Firm	sq ft	28,024	28,751	29,410	28,469	24,890	−11.2
Sales/Firm	$	68,066	82,571	102,477	106,324	97,490	43.2
Investment/Firm	$	88,343	105,944	123,817	133,496	120,203	36.1
Fuel Cost/Firm	$	5,353	7,694	9,252	10,390	10,346	93.3
Fuel Cost/$ of Sales	$	.07	.09	.09	.09	.10	48.5
Ontario							
Firms Reporting	no.	632	623	627	669	792	25.3
Area of Glass and Plastic/Firm	sq ft	38,225	39,115	38,698	38,160	34,557	−9.6
Sales/Firm	$	89,467	110,206	137,196	141,769	129,615	44.9
Investment/Firm	$	105,343	131,479	155,482	160,857	150,861	43.2
Fuel Cost/Firm	$	6,658	10,172	12,177	13,954	14,343	115.4
Fuel Cost/$ of Sales	$	.07	.09	.09	.10	.11	64.6
British Columbia							
Firms Reporting	no.	166	150	174	184	231	39.2
Area of Glass and Plastic/Firm	sq ft	20,824	25,608	27,794	27,909	22,966	10.3
Sales/Firm	$	44,444	66,559	84,528	99,495	93,326	110.0
Investment/Firm	$	111,942	140,930	157,839	179,673	156,702	40.0
Fuel Cost/Firm	$	4,205	5,402	6,745	7,859	8,331	98.1
Fuel Cost/$ of Sales	$	.07	.08	.08	.07	.08	9.4
Vegetable Producers Only							
Canada							
Firms Reporting	no.	245	265	246	272	315	28.6
Area of Glass and Plastic/Firm	sq ft	54,336	32,248	36,160	34,114	31,220	−42.5
Sales/Firm	$	49,943	29,679	38,927	38,110	37,429	−25.1
Investment/Firm	$	84,171	95,298	120,780	123,449	123,219	46.4
Fuel Cost/Firm	$	5,494	7,242	9,232	9,890	10,698	94.7
Fuel Cost/$ of Sales	$	.11	.24	.24	.26	.29	163.6

Source: Statistics Canada, *Greenhouse Industry*, Cat. No. 22-202 Annual.

The proportion of the total horticultural food system's energy used beyond the farm gate varies considerably, depending on the commodity and form of processing (Table 8). For example, with green peas the largest relative consumption of energy is in the wholesale and retail sectors when marketed as frozen peas but in the processing sector when marketed as canned peas; with potatoes, processing accounts for the greatest proportion in either frozen or dehydrated forms; with sugarbeets, processing costs are by far the largest proportion; and with apples, the largest share goes into transportation costs when in the fresh or sauce form. When apples are dried, however, the share of total energy consumed as transportation becomes relatively small and production energy then consumes the greatest part. Among the group of products listed in Table 8, energy use ranges from a high of over 8,000 Btu a pound for frozen peas to a low of about 1,800 Btu for sugar.

The distribution of total energy costs among the components of the horticultural crop subsystem differs from the distribution of energy measured in Btu, depending principally on what form of home preparation is necessary (Table 8). The energy costs for home preparation of such products as canned and frozen peas, and also fresh potatoes, account for the greatest proportion of the total energy cost. But with apples, production, processing, and transportation costs are generally more important than home preparation costs. Energy costs per pound of product produced for all commodities listed in Table 8 ranged from a high of U.S. 2.6 cents a pound for frozen peas to a low of three-tenths of a cent for sugar.

As noted earlier, the higher prices for energy related to product prices had seriously disadvantaged the production part of the industry. This factor alone, of

TABLE 8. TOTAL ENERGY USE AND COSTS IN HORTICULTURAL FOOD CROPS, 1974

Crop and Processed Form		Production	Processing	Transportation	Wholesale and Retail Trade	Home Preparation and Storage	Total Energy Use
		percent of total energy use					Btu/lb
Green Peas	– Canned	14.7	37.8	16.1	8.0	23.4	7,040
	– Frozen	12.6	13.2	9.7	36.7	27.8	8,200
Potatoes	– Fresh	13.5	–	32.5	1.3	52.7	3,030
	– Frozen Fries	8.6	50.8	13.2	12.0	15.4	4,780
	– Dehydrated	9.0	75.2	4.0	1.7	10.1	4,550
Sugarbeets as Sugar		11.4	78.2	7.1	3.3	–	1,790
Apples	– Fresh	25.7	–	56.4	4.3	13.6	3,620
	– Dried	42.4	41.0	14.0	2.6	–	3,620
	– Juice	39.1	12.3	30.1	4.2	14.3	2,380
	– Applesauce	22.0	34.9	37.0	6.1	–	4,230
		percent of total energy cost					Total Energy Cost (U.S.$) per lb
Green Peas	– Canned	14.6	22.7	12.6	6.9	43.2	.019
	– Frozen	10.7	8.7	6.4	26.8	47.4	.026
Potatoes	– Fresh	7.8	–	18.2	.8	73.2	.012
	– Frozen Fries	7.8	34.5	11.7	11.5	34.5	.012
	– Dehydrated	10.1	56.1	4.8	2.0	27.0	.009
Sugarbeets as Sugar		18.8	66.0	10.5	4.7	–	.003
Apples	– Fresh	29.5	–	40.4	3.5	26.6	.011
	– Dried	54.0	32.5	11.1	2.4	–	.006
	– Juice	42.2	8.2	20.3	3.0	26.3	.008
	– Applesauce	33.4	27.6	35.1	3.9	–	.010

Source: Norman K. Whittlesey and Chinkook Lee, *Impacts of Energy Price Changes on Food Costs*, Washington State University, College of Agriculture Research Center, Pullman, Washington, U.S., Bulletin 822, April 1976.

course, does not account for the competitive disadvantage of the greenhouse vegetable industry. The competitive product is field-grown produce from the southern United States and Mexico. One estimate is that it takes approximately 100,000 Btu a pound to grow tomatoes in an Ontario greenhouse but only 2,000 Btu a pound to truck them from the southern United States and Mexico to Canadian markets (Energy, Mines and Resources Canada, 1974). Since tomato production under field conditions requires less than 300 Btu a pound (Southwell and Rothwell),[5] it becomes extremely difficult for vegetable greenhouse operators to compete for the domestic tomato market, given the relative prices for greenhouse vegetables, levels of tariff protection, and the state of greenhouse technology at the time of writing in January 1979.[6]

There are significant differences also in energy requirements in the food processing component, depending on the form of processing. Data in Table 8 indicated that the total energy requirement for frozen peas was 16 percent higher than for canned peas. But if the home preparation and storage energy portion is excluded, the energy difference in favor of canning is reduced to 9 percent. Two other U.S. studies have investigated in more detail the energy requirements for freezing versus canning (Henig and Schoen, Londahl). These studies

[5] Based on Ontario conditions and average yields per acre of 36,000 pounds (machine-harvested) and 50,000 pounds (hand-harvested).

[6] The impact of the revised tariff schedule, announced by the federal government on March 12, 1979, to come into effect on October 1, 1979, remains to be assessed. The new schedule provides increased protection for certain fruit and vegetable products.

concluded that all steps in the food production system need to be evaluated in terms of their energy requirements because of the effects which differences in initial packaging materials, storage requirements, and time in storage and transportation can have on total energy use. For example, processed products can be packaged in cartons, cans, polyester bags, and glass jars. The energy embodied in cans (or jars) of peas is 2.2 to 4.6 times greater than that in polyester bags or cartons per retail pack. But the energy required to store frozen bags or cartons of peas is 15 times greater than when the peas are preserved in cans (or jars). Thus storage time is a more critical energy cost factor for frozen products than for canned products. The energy consumed in the transportation of canned peas, however, is 1.4 times greater than for frozen peas since the pea content of canned peas is only about 60 percent.

R.G. Greven of Catelli Ltd. stressed at the Ontario Institute of Agrologists' 1974 annual meeting that some recent developments have tended to reduce the energy consumption in the Canadian food processing industry. These included the increase in the size of the Canadian market which makes possible the use of larger and more efficient equipment and the development of new technology. For example, microwave dryers can dry macaroni products at 25 percent of the energy requirements that are required by conventional drying ovens. Greven also pointed out that direct energy costs in their company operations in 1974 accounted for only 0.8 to 1.4 percent of the total cost of the goods produced. His conclusion was that even a doubling of energy costs in food processing would not have a significant impact on their operations or those of other major food processors.

ALTERNATIVES TO PRESENT ENERGY USE

Production

The use of "waste heat" or "low-grade" heat from power plants in greenhouse vegetable production has been investigated by two Atomic Energy of Canada Limited (AECL) studies. The first of these studies, reported on in 1976, examined the economic feasibility of using waste heat from the moderator circuit of the CANDU G-2 reactor to heat greenhouses (Iverson, *et al.*, 1976). The lowest calculated heating and ventilation costs for waste heat systems were $9.55 a year per m^2 for the climate of Winnipeg. A conventional greenhouse heated by natural gas at about $1.50 per mcf would, at the time of the study, have experienced the same annual heating costs. (In 1976 the average Toronto City-Gate price for natural gas was $1.33 per mcf; it rose to $2.00 on August 1, 1978.) Under the study's assumptions, the authors concluded that the unoptimized waste heating system evaluated for greenhouses was competitive with established technology of fossil-fuel heating systems. But the authors cautioned that, while the use of waste heat for greenhouse agriculture does not hold a promise of "free" heat, it appears to be a promising concept in periods of rising fossil energy costs.

The second AECL study was undertaken in 1977 to evaluate the feasibility of using thermal effluent from the Glace Bay, Nova Scotia, heavy water plant (GBHWP) in agricultural uses (Iverson, *et al.*, 1978). Under the study's assumptions, a heating system servicing 25 acres was estimated to cost $11,800 an acre annually, compared with the average fuel costs of $20,000 an acre paid by N.S. growers in 1975; or the $25,000 an acre annual heating costs using Bunker C fuel alone at July 1977 prices. The authors concluded that any greenhouse area greater than about one acre can be heated more cheaply using heat from GBHWP than from fossil fuels. While this conclusion is relatively insensitive to assumptions about the cost of the fossil-fired system, a critical assumption was that back-up steam would be available from the Seaborad Generating Station with a high level of reliability. Also, the distance that heat has to be transported is a critical cost factor in any comparison.

In 1977 the Ontario government commissioned a study of the potential of using moderator cooling waters having a temperature of 40.5°C (105°F) for agricultural and aquacultural (fish farming) purposes from Ontario Hydro's Bruce Nuclear Power Development project (Conestoga-Rovers and Associates). The present worth of benefits and costs (1977 prices) for greenhouse tomato and cucumber production indicated benefit-cost ratios ranging from about 0.65 to 1.84, depending on the product price assumed. For a break-even operation, a gross revenue of about $68,000 an acre (1977 prices) was required over the expected facility life of 30 years. The study concluded that a greenhouse project of a size that would replace a significant part of the Ontario tomato and cucumber market being supplied by imports from the United States and Mexico was financially viable within the expected input and product price escalation rates assumed. A substantial reduction in heating costs, compared with conventional heating, was the major factor in the economic viability of the project. The costs of the project included delivery of the moderator cooling water to a site 0.8 km beyond the power plant boundary.

In the United States, the Tennessee Valley Authority (TVA) has a waste heat utilization program to identify potential uses of the low-grade energy contained in the condenser cooling water discharged from power plants, and to develop and demonstrate technology to use this energy in efficient agricultural and aquacultural systems. A 1976 report describes progress made in developing a system to utilize waste heat energy for vegetable greenhouse production using a pilot-scale greenhouse at Muscle Shoals, Alabama (Burns, *et al.*).

A cost comparison by the TVA between the environmental control system of the waste heat pilot-greenhouse and a conventional system showed that although the initial capital investment requirements for the waste heat system were higher, there was an overall cost advantage of about U.S.$17,800 an acre to the waste heat system. Future advantages are anticipated as fuel costs continue to rise at rates relatively greater than for other inputs. Plant disease was the primary associated production problem because of the high relative humidity of a waste-heat system. Effective disease control required a rigid fungicide spray program, good sanitation, and cultural practices to improve air circulation.

In addition to the foregoing applications, there are several general measures which can be adopted under the appropriate incentives to reduce energy costs and use in vegetable greenhouse production. These include the use of lower air temperatures, improved insulation, and changes in location (other than those involved in locating next to waste heat sources) to take advantage of a more favorable climate. There are also developments underway which include applications of solar energy and vertical (instead of horizontal) greenhouses.

The area of the major horticultural crops grown in the field in Canada under irrigation, including tobacco, is about one quarter of the total area of these crops grown (Table 5). Various U.S. studies indicate some of the opportunities which exist to reduce energy inputs and costs for irrigation (Farm Index). One obvious choice is to reduce water use. In one study, profits were increased by reducing water application per acre. Even though crop yields decreased slightly, the saving in energy costs was greater than the decrease in revenues. Also, as market conditions permit, producers may switch from low-value irrigated crops to those which yield a higher return per unit of irrigation water.

Opportunities also exist to improve irrigation efficiency. For example, the use of larger pipes cuts down on friction losses. But larger pipes usually mean higher initial costs and added weight. This, however, is an example of an investment designed to reduce energy requirements in irrigation. The general conclusion that these U.S. studies had regarding energy savings in irrigation is that energy prices would have to increase two or three times above existing levels (1978) before the economic incentives would favor such reinvestments. Because the cost structure of irrigation is such that fixed costs (capital costs) tend to be greater than operating costs (variable costs), the value of energy saved is often insufficient to justify the additional investments. Furthermore, reducing energy consumption in irrigation through the means suggested by these U.S. studies is only a partial solution. Higher energy prices can mean that the competitive position of irrigated agricultural production relative to non-irrigated production is weakened unless some alternative lower-cost source of energy is developed which is available only to irrigation users, or that the value of irrigated crops increases relative to the value of non-irrigated crops.

Besides the energy savings possible with more efficient irrigation systems, savings are also possible at all other stages in the production system through adopting improved and modified practices. These include substituting diesel-burning engines for gasoline engines, crop drying using more energy-efficient techniques, more fuel-efficient engines and machinery systems, modified or reduced tillage systems, substituting chemical control agents for certain tillage operations, more specific fertilizer application rates, and improvements in fertilizer and pesticide manufacture (Buffington). Possible energy savings in North American farming could range from 10 to 25 percent in the current decade, depending on function, if improved practices and known technology are adopted. By function, total savings could be as follows (Agricultural Outlook):

Function	Percent
Fertilizers-Pesticides	10
Field Operations	20
Transportation	20
Irrigation	15-20
Crop Drying-Preservation	20-25

These estimates refer to general agricultural production, not just to horticultural food crop production. But such energy savings are possible only at the costs of new capital outlays, greater labor inputs, and the substitution of any other resources which are lower-priced than energy.

Beyond the Farm Gate

Savings in energy use are possible in the food processing industries through improved housekeeping, management, and minor process changes (Buffington). For example, savings of 10 percent are said to be possible by using presently rejected heat in fruit and vegetable canning. For freezing fruits and vegetables, improved temperature-controlling devices and the latest technology could result in 5-percent overall savings. As noted previously, a microwave dryer in the manufacture of macaroni products reduces energy requirements for drying 25 percent compared with conventional drying ovens (Greven). A microwave dryer is also labor-saving. According to Greven, however, the energy savings alone, even though large, are not sufficient to justify adopting this new technology. In the case cited, the capital cost for the new dryer would have out-weighed the energy savings; energy costs more than twice the 1974 level would have been required to justify the change solely on the basis of the cost of the energy saved. This emphasizes the point that in any planned energy reductions, the benefits assigned to the energy cost reduction must be balanced against the additional costs which include the value of any output reductions.

According to some authorities, the most effective way to reduce the energy requirements in food processing would be a change in eating habits toward less highly processed foods (Steinhart). (But this could be so only if energy use for home preparation did not increase by an amount equal to the reduction in processing for the system as a whole.) Londahl says that food packaging obviously offers another opportunity for reducing overall energy requirements since, for example, packaging energy requirements account for 53 percent of the total food system's energy requirements for canned processed peas. If the peas are frozen, however, the packaging energy requirements drop to 25 percent of the total for bags and 30 percent for cartons. Recycling containers and wide use of returnable bottles could also reduce energy requirements for packaging materials although there are the energy and other costs involved in collecting and reusing containers. This can be a significant energy cost factor.

Finally, the energy costs of transporting farm and food products could be reduced. The National Research Council of Canada, in its studies of energy costs in transportation, have shown that rail freight has an "energy cost" over 90 percent less than for trucks (Science Dimension). (Energy cost is the ratio of the energy content of the fuel used in transportation to the useful work done, ignoring all other factors in total transportation costs. The useful work performance is measured in foot-pounds and represents the energy required to transport the payload a given distance.) The current trend, however, is for even greater movement of fruits and vegetables by truck because of better equipment availability, and the greater flexibility, convenience, and timeliness of trucks.

SUMMARY AND CONCLUSIONS

The Canadian economy's total energy consumption in 1976 was 6.1×10^{15} Btu. Of this amount, primary agriculture accounted for an estimated 153.1×10^{12} Btu for direct fuel use, less than 3 percent of the total. Direct and indirect energy consumption in the entire Canadian food system was an estimated 1.4×10^{15} Btu in 1975, less than one quarter of the total. Agricultural production consumed 254.7×10^{12} Btu, or 18 percent of the total food system's energy. No estimates are available of the direct and indirect energy use in the horticultural food crop system. Also, a significant part of the total energy consumed in the domestic horticultural food crop system would be for imported fruits and vegetables.

Direct fuel costs for field-grown horticultural crops are a relatively small percentage of total farm operating expenses, generally less than 5 percent, but for vegetable greenhouse production, fuel costs account for about 30 percent of operating costs or 17 percent of total costs. Hence, the impact of higher energy prices since 1974 has been much more severe for the vegetable greenhouse production part of the horticultural production section than for the non-greenhouse portion.

Beyond the farm gate much more energy, 82 percent of the total, is used in the food system than at the primary production stage. Considerable energy is expended in the processing, transportation, distribution, and home preparation of horticultural food crops. For example, it takes over 7,000 Btu, from production to consumption, to put a pound of canned peas on the consumer's table. But only 15 percent of this is used in production. The largest portion, 38 percent, is used in processing. When the energy use is priced, however, the energy cost of home preparation then becomes a much larger share of the total energy cost than the processing cost share.

Alternatives to the present levels of energy use in the horticultural food crop system are limited. Some savings can be accomplished through improved housekeeping and investments in known technology which reduce energy requirements for a given output level. But large

energy savings can only be accomplished with significant capital investments. Even at 1978 energy prices, the savings in energy alone may not justify new capital investment unless the change is accompanied by other savings, particularly in the food processing and greenhouse production sectors. Some potential appears to exist for developing low-grade or waste heat sources associated with power plants or gas transmission lines for greenhouse vegetable production, but further investigation is necessary. Many of these sources are not conveniently located to markets and there is the question as to what values will be attached to waste heat sources and convenient land sites. Another question is the reliability of these sources. Under the present cost and revenue system for greenhouse vegetables, however, the shift to higher-value products will likely continue. The higher energy prices experienced to date, however, have not had much more of an impact on the major horticultural crops grown under non-irrigated field conditions than on other types of crop farming.

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FARM MACHINERY RETAILING IN CANADA

*Archie N. Book**

In 1970 the Royal Commission of Farm Machinery described the farm machinery retailing system in Canada from the early 1900s up to 1967. This article updates that information by presenting the general trends in the retailing sector since 1960, describing several significant provincial legislative measures designed to reduce machinery and parts supply problems, and analazing some detailed financial characteristics of dealers from 1960 to date in light of the size of their margins, efficiency, and contribution to machinery price increases.

GENERAL RETAILING TRENDS

The working arrangements between farm machinery manufacturers and dealers operating in Canada have not changed radically since 1960. Most dealers still sell machinery under a contract with a single major company. A few have contracts with two or three major firms that provide limited, complementary lines. The remainder are independent dealers handling products from a variety of small, specialized companies.[1]

Today, sources of machinery for farmers differ from 1967 sources insofar as the portion of total Canadian dollar sales captured by large companies has declined. Between 1967 and 1977 the market share of the four firms with the largest sales in Canada fell from 51.3 to 47.4 percent.[2] In Western Canada (the Prairie Provinces and British Columbia), the share of the top four fell from 57.1 to 50.6 percent. In Eastern Canada (the Atlantic Provinces, Quebec, and Ontario), there was little change since its share only decreased from 42.5 to 42.4 percent. During the same period the leading eight firms' share of the Canadian market dropped from 70.8 to 66.4 percent. Once again Western Canada, where the share of the top eight decreased from 81 to 74.4 percent, was the primary reason for the decline.

The number and size of dealerships have also changed. Large, multinational farm machinery firms have been reducing the number and increasing the size of dealerships and dealers' sales areas. They have done this by expanding the operations of dealers primarily in large urban centers and closing those in small centers. This strategy enables them to reduce distribution costs, have sufficient clientele to support larger service shops, and have access to a good supply of skilled personnel qualified to repair increasingly sophisticated and expensive machinery.

Although small-volume dealers still exist, the economic factors described above continue to force them to choose between enlarging their operations or closing their businesses. This trend towards larger dealerships is clearly illustrated by the fact that total equipment,

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[1] This does not refer to general farm supply stores which might carry one or two specific types of equipment.

[2] Based on special calculations supplied by the Merchandising and Service Division, Statistics Canada, July 1978.

service, parts, and rental sales of the average-sized North American dealer rose from $378,000 in 1960 to over $1.5 million in 1976.[3] When the effects of inflation are removed, this increase is about 90 percent.

The minimum service area of dealerships currently under control with major machinery companies in Canada covers a 20- to 50-mile radius, depending on the region. In Ontario, for example, the minimum radius is 20 to 25 miles; in the Prairies it is approximately 50 miles. In both regions many dealers have customers well beyond these boundaries.[4]

The difference in dealership density between Eastern and Western Canada is explained by the amount of machinery and equipment used per acre in the two regions. In the Prairie Provinces, where extensive grain and cattle farming is dominant, the value of machinery on farms in 1976 ranged between $44 and $66 per crop and summer fallow acre. In Eastern Canada and British Columbia, where concentrated dairy, fruit, vegetable, and livestock farming prevails, the values ranged between $188 and $328 an acre.

Early in this decade, some companies found that they had made their market areas too large to provide adequate service to farmers in some parts of Western Canada. Consequently, they began introducing a "service station" concept in the early 1970s. This strategy was based on the knowledge that farmers were willing to travel long distances for major purchases but preferred to have repair services nearby. At least one large company is now introducing many repair centers and stocking them with faster-moving parts. Often these centers are simply local service and repair outlets owned and operated by major machinery dealers. This system enables a company to sell large machinery at big centers, thereby saving on distribution and inventory costs, and yet maintain effective repair service.

Another important development has been that, in response to a demand for cheaper parts, more parts wholesalers or "jobbers" are appearing in North America and underselling major companies' dealerships.[5] These wholesalers provide parts for equipment manufactured by many different companies directly to farmers at prices much lower than those of the original manufacturers. They can undercut franchised dealers for several reasons. First, they stock and handle only fast-moving parts, thereby keeping inventory costs down. Second, they buy directly from small manufacturers. This eliminates costs of going through an intermediary which are especially significant when the intermediary is a large farm machinery firm with extensive inventory control and distribution system costs. Third, some parts sold by independent wholesalers are not subject to the same quality control as that demanded by large companies. This lack of a quality quarantee enables parts wholesalers to keep prices lower.[6] Finally, some wholesalers sell directly to farmers through catalogues and offer no service to complement sales. They not only eliminate one step in the distribution chain but also avoid the expenses of a service facility.

The distribution of parts and equipment in North America has become very sophisticated during the past 17 years. Because of the increasing size and time-critical functions of modern agricultural machinery, dependable machinery and adequate repair parts delivery and service have become more important. Concurrently, higher interest rates and prices of equipment and parts have raised the costs for dealers and manufacturers carrying surplus inventories. Thus large firms have moved towards a computerized, "rationalized" distribution network. Fast-moving parts are held at the dealership level. Those with slightly lower turnover rates are stored in a regional parts distribution warehouse. Those requiring infrequent replacement are held in a central warehouse for North American or even world distribution. Since all parts movements are recorded on computer, accurate inventory controls can be maintained. This modern distribution system can ensure that most parts are delivered to farmers within 72 hours in case of an emergency.[7]

As part of their parts rationalization scheme for Canada, most major farm machinery companies have established two regional warehouse centers each, one to serve the East and the other the West. The eastern centers are located in southern Ontario because of the concentra-

[3] "Cost of Doing Business," *Farm and Power Equipment*, May issues, 1960-77.

[4] "What is Massey Up To? " *Farm Equipment Quarterly*, Vol. 3, No. 4, 1977, p. 19.

[5] This is a "feeling" of government and industry officials, not a quantitatively-based assertion.

[6] Manitoba requires all parts outlets in the province to be bonded and licensed. This is done to ensure that such outlets meet the same warranty requirements as regular dealers. Since the Farm Machinery Board claims that its bonding and licensing rules do not affect prices, the impact of reportedly stringent quality control of large companies on prices may not be as significant as is commonly believed.

[7] Prairie farm machinery acts stipulate that emergency parts must be delivered within 72 hours unless there are extenuating circumstances. Weekends and holidays are not counted since it is often impossible to obtain delivery of a shipment that ends up in the hands of a carrier over the weekend.

tion of half the eastern sales in that area. The western centers are now almost entirely in Saskatchewan, first because that province is central to the prairie market and has 45 percent of prairie sales, and second because the Saskatchewan government, under its Agricultural Implement Act, insists that manufacturers have a legal representative and supply depot in the province. This insistence has reversed the situation of the late 1960s, by which time all but one of the major companies had moved their distribution centers from Saskatchewan to Winnipeg or Edmonton.

Generally, throughout the 1960s and 70s there were several distinct trends in the farm machinery industry. The importance of major manufacturers of farm machinery declined slightly, especially in the Prairies. Dealerships grew in size but declined in number. Modernized transportation and communication systems enabled manufacturers to distribute their products more efficiently, improve their parts supply service, and maintain better inventory controls. And the growth of independent parts wholesalers provided franchised dealers with increasing parts-price competition.

PROVINCIAL FARM MACHINERY LEGISLATION

Farmers' growing dependence on machinery, coupled with the large economic impact of untimely and lengthy machinery breakdowns, have increased the concern not only of farmers and the machinery industry, but also of governments. Farmers have demanded more reliable machines, parts supplies, and service. In response, manufacturers, distributors, and retailers have tried to improve their products and service while keeping within economic constraints. Most provincial governments have added an additional measure of insurance by introducing protective legislation, or appointing mediators to investigate complaints, or both. In this way the governments hope to ensure high standards from all farm machinery suppliers and provide impartial third-party judgements in disputes that inevitably arise among farmers, dealers, and manufacturers. Some of the highlights of their efforts follow.

All provinces except Newfoundland have either established farm machinery boards or appointed people to investigate complaints related to farm machinery and act as mediators. Most complaints involve prices, machinery performance, parts and service availability, and warranty commitments. Most are based on misunderstandings which can be resolved by mediators who depend almost entirely on their powers of suasion. In provinces which have farm machinery acts, administrators of the acts perform the roles of mediators and settle at least 90 to 95 percent of the disputes. Thus only 5 to 10 percent actually reach the appointed arbitration board for resolution.[8] In provinces where only a mediator exists and the parties in the dispute have no arbitration board from which to obtain a binding ruling, the unresolved 5 to 10 percent are either handled by the courts, settled by the parties involved, or left unresolved. According to people working in the area, however, it is in the best long-term economic interests of dealers and suppliers to settle as many disputes as possible, even in provinces lacking legislation.

Only Prince Edward Island and the Prairie Provinces have farm machinery acts applying to all dealers within their jurisdiction. These acts define conditions to be met by farm machinery retailers and distributors with respect to warranties, delivery, repair parts, service facilities, machinery performance, and dealer licensing. The prairie acts also include clauses covering distributors' repurchases of parts and machinery from dealers who are closing their businesses.

Of the four existing acts, those of the Prairies are the most detailed and stringent. They have survived in some form for a long time – over 40 years in Saskatchewan and Manitoba. They are a reflection of both the economic importance of agriculture in the Prairies and the large volume of machinery sales. The stringency of the legislation, however, has had an impact on the sale of farm machinery in these provinces.

One of the economic effects of the acts has been to somewhat restrict the entry of dealers, distributors, and manufacturers of machinery into the prairie market. Distributors are restricted because they must guarantee parts availability for 10 years and post performance bonds as security. Retail dealers (businesses selling farm machinery valued over $1,000 an item) must post bonds, obtain annual licenses, and have facilities adequate for servicing the machines sold. Only licensed dealers can sell machinery valued at over $1,000. These regulations tend to eliminate very small dealers and prevent farmers who are not legitimate dealers from obtaining licenses and purchasing equipment for themselves and their neighbors at wholesale prices. They also deter hardware or general supply stores from purchasing and selling major equipment. In so doing they reduce farmers' purchase options and price competition at the retail

[8]In Alberta fewer than 1 percent are brought before the arbitration board.

level. They may even prohibit some small manufacturers that produce only a few types of specialized machinery from entering the market since these manufacturers may have difficulties finding suitable retail outlets.

It is important to recognize that the restrictions imposed by the farm machinery acts are designed to protect farmers. Since farmers demand good service and parts availability, the acts are merely attempts to ensure that farmers are buying the machinery-parts-service package that the majority of farmers have indicated they want. The legislation defines minimum standards acceptable to a technically advanced agricultural sector and eliminates some of the risk facing farmers when they buy new machinery. The restrictions and possible costs associated with the acts might be viewed as the price of reducing risk for the farmer. Entry restriction cannot be blamed entirely on the farm machinery acts. The primary impact of these acts is to reinforce the existing franchise system, a natural barrier to entry since the high costs of setting up and supporting an effective franchise network automatically limit entry to large distributors and manufacturers. Also, current economic pressures and service requirements have forced even these companies to reduce the number and increase the size of dealerships representing them. Nevertheless, the restrictions imposed by the acts accentuate the process by ensuring that no substandard dealers or distributors enter the market.

In only one overt case have farm machinery companies responded directly to conditions imposed by a farm machinery act by raising prices. This occurred in Manitoba in response to a clause in the legislation making it mandatory to provide a two-year (or equivalent hour) warranty on tractors and combines. Although some companies provided limited two-year warranties anyway, most increased their prices up to 2 percent in reaction to the clause.[9] Whether the price rise was a reflection of anticipated increased costs or whether it was a strategic move by the companies is open to debate. However, the possibility of higher farm machinery prices has prevented Alberta from implementing an amendment to its act approved in the legislature late in 1977. This amendment would make a two-year warranty on tractors, power units, combines, and self-propelled farm machinery mandatory. Alberta fears that prices might rise 1.5 to 4 percent because of the legislation and is looking for ways of averting such increases. Leaving the acceptance of such a warranty at the purchaser's discretion is one option being considered.

Saskatchewan's act is the only one that seems to have affected machinery distribution patterns and caused temporary supply problems in other provinces. Because of its requirement that manufacturers maintain a legal representative and supply depot in the province, causing most major manufacturers to move their central regional parts warehouses for the Prairies to Saskatchewan, some parts-availability problems arose in Manitoba and Alberta. Dealers in these two provinces required time to adjust their parts inventories and account for the longer lead time needed to secure parts.

Saskatchewan also has the distinction of being the only province to set up a mechanism to compensate farmers for economic hardships (i.e., time or crop loss) caused by exceptional parts delivery and service delays.[10] Cases in which farmers claim damages amounting to $5,000 or less are brought before Saskatchewan's Agricultural Implements Board. When the board makes a ruling, appeals can be filed within 30 days if there is new evidence. Once the board's final ruling is brought down, it is binding. No appeals can be made in the courts. The damage settlement and associated board members' fees are paid through a levy collected from manufacturers selling machinery in the province. This levy is small, proportional to the manufacturer's sales volume in the province (e.g., $25 a year for a firm with sales less than $500,000 a year in the province). Settlements also have been small. From 1973 to March 1978 only about $24,500 was paid in compensation. Machinery prices have therefore not been affected by this legislation.

Eight companies have challenged the constitutionality of this portion of the act. They have brought it before the courts on the grounds that the charge is an indirect tax and beyond the jurisdiction of a provincial government. They also challenge the province's right to set up and appoint a quasi-judicial body in the form of the compensation board. The reason for their action may be their concern that this portion of the act might set a precedent. This issue has not yet been settled.

Provinces without farm machinery acts have not taken the legislative approach for several reasons. The Atlantic Provinces and British Columbia believe that they do not

[9] Initially there was a higher warranty requirement and a bigger price increase but both the government and the companies involved revised their positions. The other two Prairie Provinces required a one-year warranty at that time.

[10] The bonding requirements in Manitoba and Alberta protect farmers against loss in cases in which a dealer defaults on money owed to a farmer. This could occur, for instance, when a dealer absconds with a farmer's deposit. Alberta and Manitoba farmers do not receive compensation for crop losses stemming from parts delivery and service delays.

have the market power to induce companies to bear any inconveniences that might be caused by a strong act. Quebec maintains a system of accrediting suitable dealers and prefers to use only this program to encourage companies to provide adequate parts and service facilities. Ontario has considered instituting an act in recent years, but has so far rejected the idea after studying the effects of other provinces' legislation. It believes that manufacturers, wholesalers, and retailers of farm machinery are forced, through competition, to provide good machinery, parts, and service to remain in business.

DEALER PERFORMANCE

This section concentrates on the financial performance of dealers since 1960. It analyzes the impact of changing market conditions on the behavior of dealers' margins, profits, and expenses. It examines the performance of dealers grouped into three different categories by sales volume. It also assesses farm machinery price increases during the period and indicates how much of an impact dealer margins and profits had on these increases.

Data Constraints

Since sufficient data are not available exclusively for Canadian dealers (Appendix, Table 1), combined U.S.-Canadian statistics are used. Most dealers contributing to the survey upon which the data are based are from the United States. The data therefore reflect the U.S. more than the Canadian situation. For instance, although no reliable statistics are available, the average size of Canadian dealers is likely less than the average of the surveyed North American dealers (Schwartzman). This means that Canada probably has more small- and medium-sized dealers than the survey would suggest. Nevertheless, since the North American data are provided for three different classifications of dealer, based on the size of sales, they are useful in determining the financial performance of both Canadian and U.S. firms.[11]

The usefulness of the data is limited in other ways. The data were not obtained through random sampling; they reflect the voluntary responses of dealers and do not take into account businesses that fail during the survey year. Thus the data may be biased since only the operations of successful dealers are portrayed.

Another problem is that sales of dealers assigned to a given category (e.g., small dealers) have risen sharply as a result of inflation and the real growth in the size of dealers' sales volumes. Sales rose so rapidly that there were changes in size classification in 1962 and 1968 (footnote a, Table 1). The classification changed drastically again in 1976 when small dealers were identified as those with sales up to $1 million, medium with sales between $1 and $2 million, and large with sales over $2 million. Because of the large 1976 change, data from 1976 and 1977 were excluded from the analysis to avoid distortions. The change in size classification was not severe in 1962 and did not warrant special consideration. The reclassification in 1968 was more significant and its impact on the results of the analysis were checked by using dummy variables to represent the 1960-67 and 1968-75 periods. It was concluded that any changes observed in the patterns of operating margins, expenses, profits, etc., could be attributed to overall fluctuations in sales more than to the reclassification, and that these fluctuations affected dealers of all sizes in similar ways.

Dealers' Gross Margins

The Royal Commission on Farm Machinery found that dealer size had an important effect on margins and operating efficiency. It also proposed that economies of scale could be gained by distributors and manufacturers who reorganized their distribution systems and eliminated small dealers. The present analysis, which concentrates on retail dealers and analyzes their operations using a series of multiple regression-based equations, indicates that the Royal Commission's conclusions about the relative efficiency of different sized dealers are still relevant today.

The total gross margin as a percent of the total cost of new and used machinery, service labor, parts, rental equipment, and other lines averaged almost 17 percent for all dealers between 1960 and 1975.[12] Average percentage margins were higher in the 1968-75 period

[11] One reviewer of this paper had strong reservations about using these data to describe Canadian dealers. He suggested that the statistics give a distorted picture because 1. major farm implement companies have different marketing agreements with Canadian and U.S. dealers, 2. manufacturers give bigger discounts to U.S. dealers because marketing costs in the U.S. are lower, and 3. the suggested repair parts selling price is the same across Canada even though transportation costs are higher in the West and western dealers must absorb the extra costs. He proposed that these factors might significantly alter the profit picture for Canadian dealers.

[12] In Table 1, margins are presented both as a percent of sales value and as a percent of cost. The former is the usual reference point in the trade. The latter gives a clearer picture of actual markup over cost. The latter is generally used in this paper and is sometimes referred to as a percentage markup.

TABLE 1. AVERAGE FARM MACHINERY DEALER MARGINS AND FINANCIAL STATISTICS BY DEALER SIZE,[a] 1960-75

Description	Unit of Measure	1960-67			1968-75			1960-75		
		Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Gross Margins as Percent of Purchase Cost for:										
New Equipment	%	15.7	15.6	15.7	14.2	13.3	12.7	15.0	14.4	14.2
Used Equipment	%	−0.2	−2.5	−4.8	11.6	7.4	6.5	5.7	2.4	0.9
New and Used Equipment	%	11.5	10.6	9.9	13.6	11.8	11.1	12.6	11.2	10.5
Repair Parts	%	37.1	36.5	36.2	37.6	36.9	37.0	37.3	36.7	36.6
Service Labor	%	26.3	30.4	42.5	26.5	41.5	56.5	26.4	35.9	49.5
Other Lines	%	23.5	19.7	18.1	23.7	22.1	22.5	23.6	20.9	20.3
Total Operating Margin	%	17.5	15.8	15.9	18.9	17.3	17.4	18.2	16.5	16.7
Financial Ratios:										
Profits[b] ÷ Sales	%	3.4	3.4	3.2	4.1	4.0	4.0	3.7	3.7	3.6
Profits[b] ÷ Total Assets	%	5.3	6.7	7.3	7.1	8.6	9.7	6.2	7.6	8.5
Profits[b] ÷ Net Worth	%	11.2	14.6	16.9	18.2	23.6	27.3	14.7	19.1	22.1
Current Ratio	ratio	2.0	1.9	1.9	1.6	1.6	1.5	1.8	1.8	1.7
Net Working Capital Turnover	ratio	3.9	4.8	5.8	5.2	6.5	8.0	4.6	5.7	6.9
Inventory Net Working Capital	%	1.6	1.6	1.5	2.2	2.1	2.2	1.9	1.8	1.9
Ownership Equity[c]	%	47.9	46.6	44.3	37.0	35.9	34.6	42.5	41.2	39.4
Total Asset Turnover	ratio	1.6	2.0	2.3	1.6	2.1	2.4	1.6	2.0	2.3
Total Inventory Turnover	ratio	2.0	2.6	3.2	1.9	2.6	3.0	2.0	2.6	3.1
Expenses ÷ Sales	%	14.2	13.3	13.5	14.4	13.6	13.7	14.3	13.4	13.6
Exp. Includ. Serv. Labor ÷ Sales	%	18.6	17.1	17.5	18.9	17.6	17.6	18.7	17.3	17.6
Exp. Includ. Service Labor and Interest on Investment ÷ Sales	%	—	—	—	22.1	20.3	19.9	—	—	—
Specific Sales as Percent of Total:										
New Equipment	%	52.3	54.3	51.9	54.9	56.2	53.8	53.6	55.3	52.9
Used Equipment	%	15.2	16.8	16.7	15.2	16.8	17.9	15.2	16.8	17.3
Repair Parts	%	20.0	17.4	17.8	21.0	17.7	17.0	20.5	17.5	17.4
Service Labor	%	5.5	5.0	5.7	5.6	5.6	6.0	5.5	5.3	5.9
Gross Margins as Percent of Sales for:										
New Equipment	%	13.6	13.5	13.5	12.4	11.7	11.3	13.0	12.6	12.4
Used Equipment	%	−4.3	−2.6	−5.0	10.2	6.6	5.9	4.9	2.0	0.4
New and Used Equipment	%	10.3	9.6	9.0	11.9	10.5	9.9	11.2	10.1	9.5
Repair Parts	%	27.0	26.7	26.6	27.3	27.0	27.0	27.2	26.9	26.8
Service Labor	%	20.7	23.2	29.8	20.3	28.6	35.8	20.5	25.9	32.8

[a] Before 1962, small dealer data refer to dealers with $100,000 - $250,000 sales only. In 1962 this was changed to all dealers with less than $250,000.
Dealer classifications from 1962-67 are: small, up to $250,000 sales; medium, $250,000 to $500,000; large, over $500,000.
Dealer classifications from 1968-75 are: small, up to $500,000 sales; medium, $500,000 to $1,000,000; large, over $1,000,000.

[b] Net Operating profit before income taxes.

[c] Total assets less total liabilities divided by total assets.

Source: *Farm and Power Equipment,* "Cost of Doing Business," May issues, 1961-76.

because of the equipment and parts shortages during the 1970s (Table 1). Gross margins of small dealers averaged greater than 18.2 percent while those of large dealers were 16.7 percent. Medium-sized dealers' margins, at 16.5 percent, were not significantly lower than those of the large dealers.

There are several reasons for the difference in margins of different-sized dealers. One is product mix, i.e., a greater proportion of small dealers' sales are repair parts which have higher markups than new and used machinery, the major sales item. Another is that small dealers have higher markups on all items, except service labor, than medium and large dealers. Medium-sized dealers have slightly lower overall margins than large, almost entirely because the lowest margin items, new and used equipment, account for 2 percent more of their total sales. Additionally, medium-sized dealers' margins on one of the highest margin items, service labor, are much lower than those of large dealers, and service labor accounts for 0.5 percent less of total sales than is the case for large dealers.

Gross margins as a percent of the cost of new machinery declined markedly between 1960 and 1972, but rose in 1973 because of equipment shortages stemming from unexpectedly strong demands (Figure 1; Table 2C; Appendix). Although the decrease in new machinery margins might be interpreted as a sign of increasing competition and efficiency, it is largely an accounting illusion caused by the way dealers have handled used machinery. As shown in Figure 1, rising used machinery margins almost entirely offset falling new equipment margins until 1973 when tight supplies changed the market situation. This means that the gross margins on both new and used machinery are related to the trade-in values dealers assume they have allowed on used machinery. The real values of trade-ins are better determined by the values at which dealers sell them.[13] Thus by examining the combined gross percentage margins on new and used machinery, one obtains a more accurate picture of the real trends of gross margins on equipment sales.

The combined gross margin on new and used machinery averaged 10.8 percent between 1960 and 1975. It declined slightly until 1972, after which it rebounded sharply in the face of reduced inventories (Figure 1; Table 2C, Appendix). The high margins of 1973-75 caused 1968-75 averages to increase 1 to 2 percentage points above 1960-67 averages. This seems to indicate that dealers can affect price increases significantly during acute machinery shortages and that they are sensitive to strong competitive forces. The data, however, offer only a partial confirmation of this thesis. Inventory turnover, one measure of supply-demand balance, was found to account for only 40 percent of the total variation in margins over the 16-year period. This implies either that the data are not good enough to pick up the responses accurately or that dealers, on the average, are not usually as responsive to market conditions as was previously believed.

No variation was observed in the direction of margin movement according to dealer size. Small dealers' percentage markups on new and used machinery, however, averaged almost 2 percentage points higher than those of large dealers. Medium-sized dealers fell between the two extremes. Barring some product differentiation, this must mean that small dealers have higher prices than large. When one considers that large dealers probably obtain bigger volume discounts than small, small dealer prices must be several percentage points higher.

There are at least several reasons for the markup differentiation. One is that small dealers' inventory turnovers on new and used machinery are lower, 2.1 times a year compared with 3.3 times for large. Since the markups cover fixed as well as variable business costs, large dealers must gain some economies of scale with higher inventory turnovers. But even when differences in inventory turnover are accounted for, small dealers' margins are almost 2 percentage points higher. Thus other reasons might be that they do indeed sell different products or that they might simply charge more for machinery to cover shop costs related to the service aspect of their operation. These costs may not be adequately covered by the service labor markups which are substantially lower than those charged by large dealers. (See footnote 14.)

How can small dealers survive with higher prices, not only for new and used machinery but also for repair parts and other lines? As the Royal Commission pointed out, they might be selling in localized markets untouched by larger dealers. This isolation may be regional (e.g., the small Atlantic market) or it might be a reflection of marginal agricultural areas along the boarders of large, productive regions. Alternatively, small dealers may handle more specialized products of small companies not competing directly with large dealers. Another possibility is that farmers have difficul-

[13] This is not strictly correct since dealers may spend a considerable amount on reconditioning a machine. This cost, however, should be built into the dealer's trade-in allowance and reflected in the cost and sale value of the used machine. Therefore, the subsequent sentence still holds true. In that sentence the "combined gross margin on new and used machinery" is the sum of the absolute values of the markups on new and used machinery expressed as a percent of the total cost to the dealer of the two types of machinery.

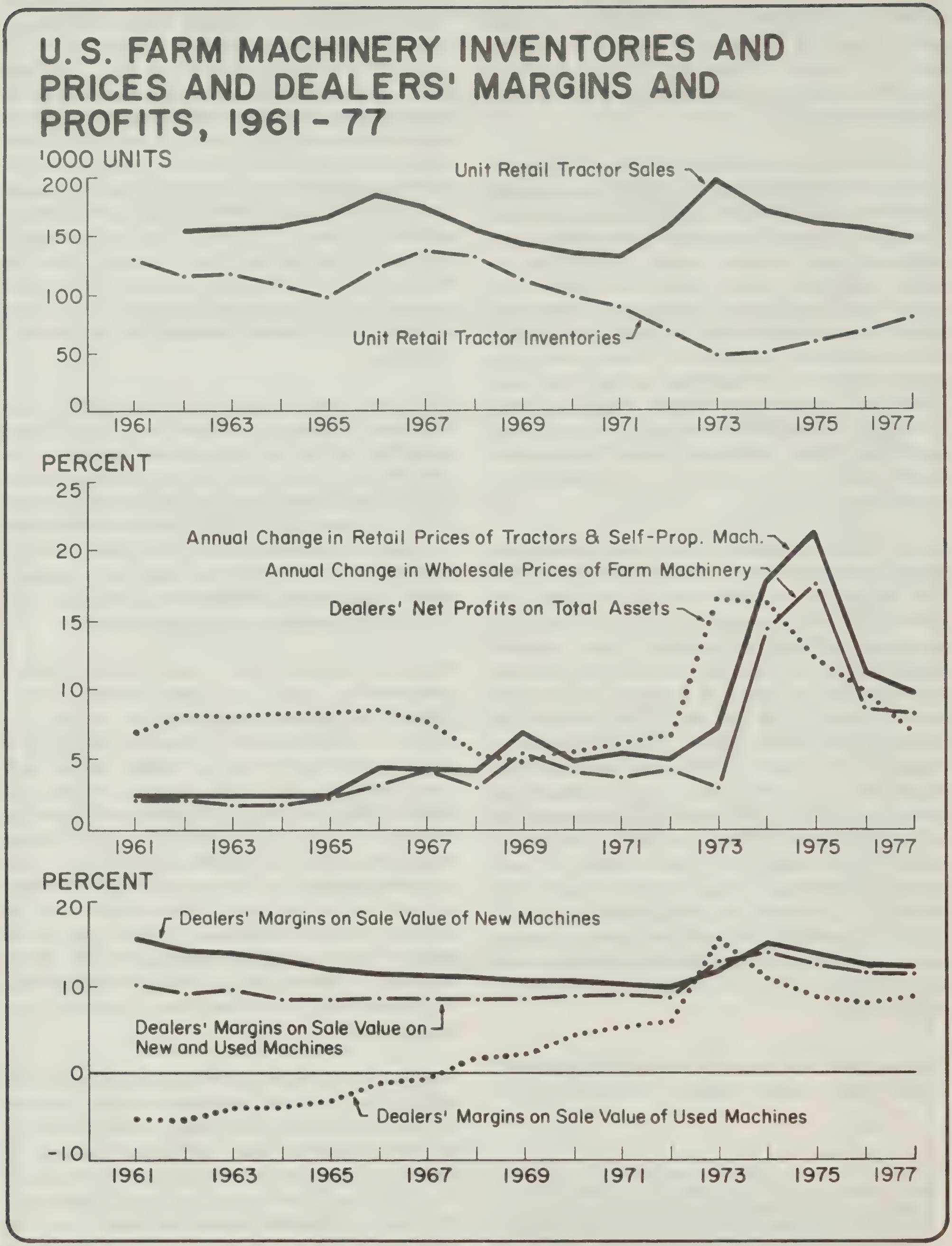
U.S. FARM MACHINERY INVENTORIES AND PRICES AND DEALERS' MARGINS AND PROFITS, 1961 - 77
'000 UNITS
Unit Retail Tractor Sales
Unit Retail Tractor Inventories
200
150
100
50
0
1961
1963
1965
1967
1969
1971
1973
1975
1977
PERCENT
Annual Change in Retail Prices of Tractors & Self-Prop. Mach.
Annual Change in Wholesale Prices of Farm Machinery
Dealers' Net Profits on Total Assets
25
20
15
10
5
0
PERCENT
Dealers' Margins on Sale Value of New Machines
Dealers' Margins on Sale Value on New and Used Machines
Dealers' Margins on Sale Value of Used Machines
20
10
0
-10

Figure 1

ties detecting price differences because of the variability of trade-in allowances. Finally, it might simply take more time for small dealers to be forced out of business.

Gross percentage markups on repair parts averaged nearly 37 percent during 1960-75. Small dealer markups were half a percentage point higher than those of large. There was no significant linear change in the markups over time, although the 1968 to 1975 averages were higher than those of the previous eight years (Table 1). Parts inventory turnovers of small dealers averaged 1.4 times a year while those of large averaged 2.3 times. Despite this difference, no statistically significant correlation existed between markups and inventory turnovers, an unexpected finding since dealers carry costs of financing parts inventories themselves.

Percentage markups on service labor are the only ones which are higher for large dealers than for small.[14] This means that farmers pay higher shop rates at large dealerships than at small. Between 1960 and 1975, large dealers' markups averaged 49.5 percent of service labor costs compared with 26.4 for small. From 1968 to 1975 the difference was even more marked, with large dealers averaging 56.5 percent and small, 26.5. Thus the differences in rates must be substantial even if service labor costs of different-sized dealers are equal. The distinction is probably more pronounced than the margins indicate since large dealers usually are in larger centers and must pay higher wages, first to compete with other businesses for mechanics and second to obtain the more highly skilled people available in the bigger labor pool.

Several causes of the higher service labor markups of large dealers exist. One is that larger dealers have more expensive, sophisticated shops as well as larger employee benefits to be paid out of this margin. A second is that small dealers may underestimate their real costs because of faulty records. A third is that small dealers cover their shop costs and employee benefits out of the higher markups on their other sales items. This may even be one way of competing with large dealers — offering cheaper service in compensation for higher initial machinery prices.

The large dealers' markups on service labor, which have risen significantly, have caused the average markups for all dealers to increase between 1960 and 1975 (Table 1). This increase has not been due to the general fluctuations in farm machinery market conditions or rising sales; it simply reflects dealers' rising shop costs, employee benefits, insurance, and other business expenses.

Expenses, Profits, and Efficiency

Margins, although of special interest to purchasers of machinery and services as well as to dealers, are only part of the retailing picture. They are also only partial indications of the retailing operation's efficiency. Expenses and profits are two more directly applicable measures of efficiency.

During the 1960-75 period, operating expenses as a percent of sales averaged 13.8 (excluding 4.1 percent for service labor costs and an additional 2.0 to 2.4 percent for inventory carrying charges).[15] Neither the general trend towards larger dealers nor the supply-demand situation as reflected in inventory turnover was found to be significantly related to changes in this ratio. There was also no significant upward or downward trend in the ratio during the period; however, it did fall during the major sales peaks (1967 and 1973) and rise during the troughs (1970 and 1975). Also, although large dealers' ratios are only 95 percent of the size of those of small dealers, there seems to be little benefit in becoming too large since medium-sized dealers' average ratios are about the same as those of large dealers.

When service labor and inventory carrying charges are added to the operating expenses, the efficiency of larger dealers becomes more apparent (Table 1). In the 1968-75 period, with an assumed 10-percent interest charge on inventories, large dealers' expenses as a percent of sales averaged 19.9 while small dealers' averaged 22.1 percent. The former is 90 percent of the latter, an indication of the relative efficiency of large dealers. These ratios can be compared with the 17.7 percent for large dealers and 21.5 for small, calculated by the Royal Commission in 1967 when interest rates were assumed to be 7.5 percent. Thus it seems that large

[14] The big markups caused service labor to make up 14 percent of large dealers' total gross margins compared with 7 percent for small dealers. These markups represent the difference between what dealers pay for service and what they charge for that labor. Theoretically, service labor margins cover shop and other service-related expenses (including a reasonable profit) but, as pointed out in subsequent paragraphs, this is not necessarily the case.

[15] Operating Expenses refer to all costs excluding dealer's costs of purchasing new and used machinery, repair parts, service labor, rental equipment, and other lines. They include salaries for office personnel and salesmen, interest payments, heat, property taxes, employee benefits, shop expenses, and insurance.

dealers have been, on the average, more efficient than small dealers, but not quite as efficient as the Royal Commission's data for 1967 indicated.

There are several reasons for the apparently greater efficiency of large dealers. One is that there are economies of scale in selling large volumes; overhead costs do not increase as fast as sales volumes so larger dealers have lower overhead costs per dollar of sales. Another reason that is noticeable when all inventory interest charges are included is that lower inventory turnovers raise small dealers expenses as a percent of sales relative to those of large dealers approximately 5 percent. The importance of high inventory turnover has grown with the higher interest rates of the 1970s. Since the interest costs associated with a good portion of dealers' inventories are still carried by manufacturers, they are a stong incentive for the industry to continue shifting to large dealers.[16] A third reason is that the sales composition of large dealers differs from that of small dealers. For example, a greater percentage of small dealers' sales were accounted for by repair parts; these are much more expensive items to sell than whole goods since they involve slower moving inventories and greater inventory handling expenses. Because of differing markup strategies of small and large dealers, it is impractical to adjust the expenses to show the same returns, as was attempted by the Royal Commission.[17] Suffice it to say that smaller dealers have remained less efficient than large dealers and that higher interest charges have increased the push towards larger dealerships.

The conclusions regarding dealer efficiency as measured by expenses as a percent of sales are also reflected in profits as a percent of total assests, of total sales, and of net worth. The average return on total assets was 7.9 percent between 1960 and 1975. If the unusually high profit years (1973, 1974, and 1975) are excluded, the average return was less than 6.4 percent. As expected, small dealers had the lowest returns, 27 percent lower than those of large dealers. Part of these low returns is a reflection of the low inventory turnover of small dealers. If all inventory costs had been deducted from profits, small dealers' performance would have been even worse relative to that of large dealers.

As might be anticipated, profits on total assets showed a high, positive correlation with inventory turnover and retail prices ($\bar{R}^2$ = .90).[18] They were also positively correlated with total sales deflated by the U.S. retail price index for farm power equipment ($\bar{R}^2$ = .74). The correlation with retail machinery prices (measured as the U.S. retail price index for tractors and self-propelled machinery) is to be expected since dealer margins affect (or are affected by) retail prices. Since inventories are parts of total assets, it is also not surprising that higher inventory turnover caused increased profits on total assets.

Profits on net worth, which averaged 20 percent over the period, exhibited fluctuations similar to the movements of profits on total assets. One of the primary explanatory variables is price-adjusted sales (positively correlated with an $\bar{R}^2$ of .84). Profits on net worth, however, have also been rising, a reflection of rising sales per dealer and declining ownership equity (Table 1).[19] Another characteristic of the returns on net worth is that since small dealers have higher ownership equity ratios than large (probably because they have more difficulty getting outside financing), their returns on net worth are only 66 percent as high as those of large dealers.

Profits on sales averaged 3.7 percent during the 16-year period and were as high as 5.7 percent in the 1973 boom year. During this period they were positively correlated with the ratio between retail and wholesale price indexes for farm machinery but the correlation was weak. Not surprisingly, they were also correlated with the combined percentage markup on new and used machinery ($\bar{R}^2$ = .87). No significant upward trend in profits has occurred since 1960. The high average profit on sales for 1968-75 (Table 1) is due solely to the exceptionally tight supply situation of 1973-75.

Profit fluctuations on sales during the period generally have been similar for all sizes of dealer (Table 1). During

[16] The high interest costs have also caused manufacturers to modify the extremely favorable interest-free floor-planning terms of the 1960s and shorten the time during which dealers can hold machinery on their property interest-free (Fulkerson). This is a step towards following the recommendations of the Royal Commission on Farm Machinery which proposed banning interest-free floor-planning entirely (Barber). It encourages dealers to have better sales estimates and inventory control.

[17] Schwartzman, David, Oligopoly in the Farm Machinery Industry, Study No. 2, Royal Commission on Farm Machinery, Information Canada, Ottawa, 1970, p. 180.

[18] This is the adjusted coefficient of multiple determination which means that the two variables mentioned can be used to explain about 90 percent of the profit variation on total assets.

[19] One reason for the decline is that farm machinery has become so large and expensive so rapidly that dealers' internal financing capabilities have not been able to keep pace. Another is that many dealers have had to expand their shop and building facilities to accommodate larger sales volumes and sophisticated servicing requirements.

the peak sales years of 1966 and 1973, however, small dealers' profits were over 1.5 percentage points higher than large dealers' profits, and during the 1968-71 period of poorer sales, they were as much as one percentage point lower. Thus small dealers seem to suffer and benefit more from sales cycles than large dealers. This might be due to small dealers, in good years, beginning to realize economies of scale already enjoyed by larger dealers.

It is impossible to state categorically what has happened to efficiency since 1967 or even 1960. The machinery scarcities and exceptionally high demands of the early 1970s distorted margins and profits to such an extent that overall trends are obscure. Nevertheless, several conclusions can be inferred. One is that medium- and large-sized dealers still appear to be more efficient than small, especially if expenses as a percent of sales is used as a measure of efficiency. A second is that no statistically significant trends in the efficiency level were observed during the 1960-75 period.

Prices

One final interesting aspect, as much to purchasers as to dealers, is how dealers were able to influence retail machinery prices during 1960-75. Some of their impact has already been mentioned. Average markups for new and used machinery were at their highest in 1973-75 when supplies were scarce and price increases large. In that period markups jumped from 9.6 percent in 1972 to 14.3 in 1973 and 16.4 in 1974. They then fell to 14.1 percent in 1975 and to 12.9 percent in 1976. Had wholesale prices remained constant during the period, these markup fluctuations would have changed retail prices by the following percentages:[20]

1972-73	+4.7%
1973-74	+1.8%
1974-75	–2.0%
1975-76	–1.0%

As it was, U.S. wholesale prices on all agricultural machinery rose 2.9 percent in 1972-73, 14.2 in 1973-74, 17.2 in 1974-75, and 8.3 in 1975-76. Under these circumstances, if the dealer markups on new and used machinery described in the previous paragraph had been maintained and no additional charges like transportation costs had affected retail prices, retail machinery prices would have risen as follows:[21]

1972-73	7.3%
1973-74	16.3%
1974-75	14.9%
1975-76	7.2%

In this case markups would have caused 64 percent of the actual retail price increase in 1972-73, 24 in 1973-74, 1 in 1974-75, and –1 in 1975-76. This shows that the contribution of dealers' margins to price increases was extremely variable and that if wholesale prices rise quickly enough, dealers can contribute to the price increases even though they reduce their margins (e.g., in 1974-75).

To bring the analysis into a more general framework, several tests were done comparing U.S. retail price indexes on tractors and self-propelled machinery with wholesale prices of all U.S. manufactured agricultural machinery. It was found that their correlation was high (the equation was as follows: Retail P.I. $= -36.7 + 1.36$ Wholesale P.I.; corrected $\overline{R}^2 = .99$).[22] Although one may have legitimate reservations about comparing retail prices of only *some* machines (i.e., tractors and self-propelled machines) with wholesale prices of *all* agricultural machinery, this analysis implies that retail prices are largely a reflection of wholesale prices and that most of the dealers' effects on price changes are encompassed in the impact of constant percentage markups. Since we know that up until 1973 combined markups on new and used machinery varied little, the implications of the analysis on the average are probably quite accurate. This is not to say that dealers do not contribute to price increases. As was seen even with declining markups, some of the price increase can often be attributed to retailers, and in years of extremely tight supplies, as in 1973 and 1974, dealers can affect price changes significantly. In general, however, much of the cause of price increases must be found within the cost and institutional structure of the manufacturing-wholesaling network as well as the overall supply-demand relations and inflation in the economy.

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[20] Calculated as follows: (wholesale price in 1973 X retail markup in 1973) ÷ (wholesale price in 1972 X retail markup in 1972), etc.

[21] The actual U.S. retail price index for farm machinery rose 7, 17, 21, and 15 percent in the respective years. Reasons for the differences between these increases and those calculated in the text might include transportation cost and sales tax changes that affect the retail price index. The differences might also reflect inaccuracies in the data.

[22] Lagged wholesale prices were also tried but proved to be an inferior explanatory variable.

SUMMARY

There have been several important changes since 1960 in the distribution network for farm machinery in Canada. The average dealer size in terms of total sales value has more than quadrupled. The number of dealers has declined and market areas of dealerships have grown. The share of the western market controlled by the four leading manufacturers has fallen. More effective communication and transportation systems have enabled manufacturers and distributors to centralize the parts distribution system. Higher interest rates and more expensive equipment have forced manufacturers and dealers to handle inventories more efficiently. All changes have tended to further centralize the sales and service of farm machinery.

Since 1960 concern for reliable equipment, warranties, and parts service has increased with farmers' growing dependence on larger and more costly equipment. Provincial governments have stepped up their efforts to ensure that companies and dealers provide the service and equipment demanded by farmers. To do this, some have introduced and strengthened acts governing the sale and service of farm machinery in their province. Others have appointed mediators to investigate and arbitrate disputes. These mediators have settled most farmer-dealer-manufacturer disputes, assisted farmers in obtaining parts, caused changes in the wholesale distribution network, enhanced the trend towards larger dealerships, encouraged reliable equipment sales and service, and in some cases provided manufacturers with reasons to raise prices in the face of legislation on warranty requirements.

Dealers have also experienced wide fluctuations in margins, profits, sales, and inventory turnover. The principal reason for these fluctuations was the equipment short-fall that arose in the 1973-76 period of strong demand which had not been anticipated by manufacturers. Small dealers continued to be less efficient than large but differences between large and medium dealers were not pronounced. Apart from the unusual 1973-76 period, no significant changes were detected in dealers' profit margins or economic efficiency.

Retail price changes during the 1960-76 period are largely a reflection of the impact of wholesale price changes. Dealers, however, contributed to the overall increase insofar as they maintained their margins at a fairly constant level until 1972. From 1972 through 1975, dealers were a more important cause of high machinery prices because they increased and maintained higher margins.

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APPENDIX

TABLE 1. CANADIAN FARM MACHINERY DEALERS, FINANCIAL STATISTICS, 1960-75

Year[a]	Net After-Tax Profits as Percent of Sales[b]	Net After-Tax Profit as Percent of Net Worth[c]	Returns[d] as Percent of Total Assets[e]	Cost of Sales as Percent of Sales
1960	3.5	14.2	n.a.[f]	n.a.
1961	2.5	12.7	n.a.	n.a.
1962	2.8	12.3	n.a.	n.a.
1963	2.5	14.7	n.a.	n.a.
1964	2.4	14.4	n.a.	n.a.
1965	2.1	13.6	n.a.	n.a.
1966	2.4	17.7	n.a.	90.1
1967	1.7	11.7	n.a.	91.6
1968	1.6	10.1	7.6	n.a.
1969	0.5	2.8	4.3	83.3
1970	−1.4	−7.7	1.1	84.7
1971	2.2	13.2	6.2	85.0
1972	2.3	17.3	7.6	85.1
1973	3.1	23.9	10.5	85.6
1974	4.0	32.1	13.5	85.0
1975	3.2	26.2	10.3	85.2

[a]Before 1965 the figures included data from electrical machinery dealers as well as farm machinery dealers.
[b]Net After Tax Profits = income remaining after all expenses (including interest on debt, depreciation, and income taxes) have been deducted. It would be the same as Net Operating Profits in Table 2A if income taxes were deducted from the latter.
[c]Net worth = common and preferred shares outstanding, preferred earnings, and other surplus accounts.
[d]Returns = Net After Tax Profit with all interest expenses added back. Returns on Assets indicate relative profitability on total resources employed.
[e]Total Assets = current, fixed, and other assets, less accumulated depreciation.
[f] = Not available.

Source: Canadian Imperial Bank of Commerce, *Commercial letter,* Issue No. 1, 1977 and previous issues.
Statistics Canada, *Corporation Financial Statistics,* Catalogue No. 61-207, 1978.

TABLE 2A. FARM MACHINERY DEALER MARGINS, EXPENSES, AND PROFITS AS A PERCENTAGE OF SALES,[a] 1960-77

Year	Total Operating Margin[b]	Margin on New and Used Machines[c]	Margin on New Machines[c]	Margin on Used Machines[c]	Margin on Repair Parts[c]	Margin on Service Labor	Percentage of Total Sales: Total Operating Expenses	Percentage of Total Sales: Net Operating Profit Before Tax[d]
				percent				
1960	15.1	10.2	16.2	−7.5	27.3	28.4	15.1	2.8
1961	14.7	10:2	15.4	−5.1	27.4	24.7	14.6	3.0
1962	14.3	9.3	14.2	−5.5	26.9	27.2	13.9	3.2
1963	14.0	9.5	13.9	−4.5	27.0	27.0	13.7	3.3
1964	13.6	8.9	13.2	−4.1	26.8	27.3	13.3	3.3
1965	13.0	8.2	11.8	−3.4	26.8	28.7	12.7	3.2
1966	12.8	8.6	11.7	−1.8	26.0	29.3	12.2	3.5
1967	12.4	8.4	11.1	−1.1	25.6	25.9	12.2	3.3
1968	13.1	8.6	10.8	−1.4	26.7	25.4	13.4	2.9
1969	13.5	8.4	10.4	1.9	26.3	29.5	14.0	2.5
1970	14.2	8.8	10.3	4.2	27.5	31.9	14.2	3.0
1971	13.9	8.8	10.1	4.9	27.1	32.9	13.7	2.9
1972	14.0	8.8	9.7	5.7	27.9	35.1	13.6	3.1
1973	16.1	12.6	11.5	15.4	25.2	35.5	12.8	5.7
1974	17.3	14.1	14.9	10.9	26.7	30.8	13.6	6.0
1975	16.2	12.4	13.4	8.8	28.0	29.4	13.3	5.3
1976	15.7	11.4	12.5	7.9	29.4	32.2	13.8	4.2
1977	15.7	11.1	12.0	8.2	29.6	32.4	14.4	3.6

[a]These figures are based on the average of reporting-dealers' returns, margins, sales, etc. Some Canadian dealers responded to the survey as well as U.S. dealers.
[b]Includes gross margins on sales, service, and leases expressed as a percentage of total sales (expenses and taxes have not been deducted and miscellaneous income has not been added to the margin).
[c]Represents gross profit on machines or parts expressed as a percentage of the sales value of the machines or parts (expenses and taxes have not been deducted from the margins).
[d]Represents gross profit on sales, service, and leases (before expenses and taxes), less total expenses.

Source: *Farm and Power Equipment,* "Cost of Doing Business," May issues, 1961-78.

TABLE 2B. ANNUAL TURNOVER RATIOS AND RETURNS OF FARM MACHINERY DEALERS, 1960-77[a]

Year	Total Asset Turnover[b]	Total Inventory Turnover[c]	New Equipment Inventory Turnover[d]	Repair Parts Inventory Turnover[d]	Net Profit[e] on Total Assets	Net Profit on Net Worth[f]
	—	ratio		—	— percent	—
1960	n.a.[g]	n.a.	n.a.	n.a.	6.5	10.6
1961	1.9	2.6	2.5	1.9	6.7	11.2
1962	2.1	3.0	3.0	2.1	7.9	14.5
1963	2.1	3.0	3.4	2.0	8.0	15.0
1964	2.2	3.0	3.0	2.0	8.1	15.8
1965	2.2	3.2	3.3	2.1	8.1	16.4
1966	2.1	2.8	2.7	2.0	8.4	19.5
1967	2.0	2.7	2.4	2.0	7.5	18.6
1968	1.8	2.2	2.0	2.0	5.4	15.7
1969	1.9	2.3	2.1	2.1	4.7	13.2
1970	1.8	2.1	1.9	1.9	5.4	15.9
1971	2.0	2.4	2.2	2.1	5.9	18.2
1972	2.0	2.7	2.6	2.1	6.4	19.8
1973	2.8	3.9	4.8	3.7	15.9	40.3
1974	2.5	3.4	3.5	2.4	15.9	40.3
1975	2.3	2.8	2.9	2.3	12.2	34.8
1976	2.2	2.6	2.7	2.2	9.5	29.5
1977	1.9	2.1	2.2	2.0	6.7	18.6

[a]These figures are based on the average of reporting-dealers' inventories, profits, net worth, etc. Some Canadian dealers responded to the survey as well as U.S. dealers.

[b]Total sales divided by total assets = turnover of total assets. Assets include cash and securities, accounts and notes receivable, inventories, fixed assets, finance reserves, and other assets.

[c]Equals dealer cost of sales of new and used equipment, repair parts, other lines, and rental-lease income divided by dealer value of total inventory.

[d]Equals dealer cost of sales of new equipment (or repair parts) divided by dealer value of inventory of new equipment (or repair parts).

[e]Net operating profit before income taxes. (See footnote d, Table 2A.)

[f]Total assets minus total liabilities = net worth (or equity).

[g]Not available.

Source: *Farm and Power Equipment,* Cost of Doing Business, May issues, 1961-78.

TABLE 2C. FARM MACHINERY DEALER MARGINS AS A PERCENTAGE OF DEALER COST,[a] 1960-77

Year	Total Operating Margin	Margin on New and Used Machines	Margin on New Machines	Margin on Used Machines	Margin on Repair Parts	Margin on Service Labor
			percent			
1960	17.8	11.4	19.3	−7.0	37.6	39.6
1961	17.2	11.4	18.2	−4.9	37.7	32.8
1962	16.7	10.2	16.5	−5.3	36.8	37.4
1963	16.3	10.4	16.2	−4.3	36.9	37.0
1964	15.7	9.8	15.1	−4.0	36.5	37.6
1965	14.9	8.9	13.4	−3.3	36.5	40.2
1966	14.7	9.5	13.3	−1.8	35.1	41.4
1967	14.2	9.1	12.5	−1.0	34.4	35.0
1968	15.0	9.4	12.1	1.4	36.4	34.0
1969	15.6	9.1	11.7	1.9	35.8	41.8
1970	16.6	9.6	11.5	4.4	38.0	46.9
1971	16.1	9.6	11.2	5.2	37.3	49.0
1972	16.3	9.6	10.8	6.0	38.7	54.1
1973	19.2	14.3	13.0	18.2	33.7	55.1
1974	20.9	16.4	17.5	12.2	36.6	44.6
1975	19.3	14.1	15.5	9.6	38.9	41.5
1976	18.6	12.9	14.3	8.6	41.6	47.6
1977	18.6	12.5	13.7	8.9	42.1	47.9

[a]For descriptions of the data see Table 2A.

Source: *Farm and Power Equipment,* "Cost of Doing Business", May issues, 1961-78.

ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE

Item	Units or Base	1977 I	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual
Production and Income											
1. GNP at Market Prices[a]	$ mil.	202,852	207,956	212,308	217,412	210,132[b]	222,684[b]	229,600[b]	235,364[c]	239,692	231,835
2. Farm Cash Receipts Total[d]	$ mil.	2,660.0	2,222.9	2,624.3	2,664.8	10,171.9	2,904.0	2,705.6[c]	2,954.7[c]	3,323.1[c]	11,879.5
3. – Total Crops[d]	$ mil.	1,427.0	754.5	1,107.5	1,140.0	4,429.0	1,468.8	1,004.7[c]	1,148.6[c]	1,312.3[c]	4,934.4
4. – Total Livestock[d]	$ mil.	1,142.7	1,308.6	1,393.4	1,401.1	5,245.8	1,354.6	1,608.6[c]	1,711.2	1,894.3[c]	6,568.7
5. Net Income Rec'd by Farm Operators[a]	$ mil.	2,800.0	3,656.0	2,940.0	2,744.0	3,035.0	3,480.0[b]	4,800.0[b]	4,172.0[b]	4,528.0	4,244.0
Trade											
6. Agricultural Exports	$ mil.	941.0	1,115.0	1,120.0	1,088.9	4,264.9	945.4	1,230.5	1,261.4	1,390.1[c]	4,828.4[c]
7. Agricultural Imports	$ mil.	867.0	980.5	827.5	880.9	3,555.8	876.6	1,088.5	943.2	1,104.4[c]	4,012.7[c]
8. Real Domestic Product, Ag[a]	1971=100	95.5	100.6	104.2	104.8	101.3	109.9[b]	107.4[b]	109.8[b]	108.9	109.2
9. Real Dom. Prod. Less Ag[a]	1971=100	129.3	129.4	130.2	131.1	130.0	132.2[b]	133.4[b]	134.8[b]	136.7	134.2
Price Indexes											
10. Farm Input Price Index	1971=100	175.6	181.2	181.3	181.7	180.0[c]	187.3	196.7	199.7	205.5	197.4[c]
11. – Buildings and Fencing	1971=100	177.9	180.8	186.7	190.0	183.9	193.4	197.6	203.1	209.7	201.0
12. – Machinery & Motor Veh.	1971=100	159.9	163.7	165.0	169.1	166.4	172.6	174.0[b]	176.0[b]	181.7	176.1
13. – Crop Production	1971=100	207.8	210.6	214.1	214.5	212.5	217.9[b]	224.1[b]	207.0[b]	229.5	224.6
14. – Animal Production	1971=100	162.0	173.2	169.3	165.2	167.4	178.0	203.7	207.3[b]	217.7	201.7
15. – Hired Farm Labor	1971=100	203.2	207.0	211.0	213.0	208.6	214.5	217.9	223.9	225.4	220.4
16. – Interest	1971=100	242.8	242.8	242.8	242.8	242.8	242.8	242.8	242.8	242.2	242.8[c]
17. Farm Prices of Ag. Prod.[d]	1961=100	213.1	222.1	218.8	216.4	217.6[b]	222.2[be]	234.6[e]	210.7	NA	NA
Input and Credit											
18. Farm Impl. & Equip. Sales[f]	$ mil.	163.7	298.3	379.1	283.4	1,124.5	153.9	372.9	418.8	342.4	1,288.0
19. Employment in Agriculture[a]	'000	461.7[b]	464.7[b]	470.3[b]	472.7[b]	468.0	460.3	466.0	481.7	495.3	475.8
20. Av. Farm Labor Rates[d]	$/hr	3.49	3.54	3.61	3.66	3.56	3.67	3.73	3.78		
21. Av. Hourly Earnings-Manuf.	$/hr	6.16	6.34	6.44	6.57	6.38	6.67	6.77	6.87	7.03[c]	6.84[c]
22. F.C.C. – Gross Loan Disburs.	$ mil.	77.8	129.9	175.7	125.4	508.8	78.4	127.8	205.7	121.7	533.6
23. F.I.L. – Loans Made	$ mil.	24.9	51.6	53.1	34.1[c]	163.7	37.8[c]	NA[g]	NA	NA	NA
24. CPI – All Items	1971=100	155.5	159.1	162.6	166.1	160.8	169.2	173.3	177.7	180.5	175.2
25. – Food at Home	1971=100	168.0	175.9	182.7	188.6	178.8	194.8	208.3	218.7	216.4	209.6
26. – Food Away from Home	1971=100	184.1	185.8	188.3	190.0	187.0	192.6	194.9	202.2	207.3	199.3

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE (Concluded)

Item	Units or Base	1977 I	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual
27. Industry Selling Price Index – Food & Beverage	1971=100	178.8	187.3	187.9	189.2	185.9	194.9	203.9	209.5	213.5[c]	305.5[c]
Other Indicators											
28. Unemployment Rate[a]	%	7.9[b]	8.0[b]	8.2	8.4	8.1	8.4	8.6	8.5	8.2	8.4
29. Exchange Rate	$ U.S.	1.03	1.05	1.07	1.10	1.06	1.11	1.13	1.14	1.18	1.14
30. Av. Rate on New Demand Loans	%	9.1	9.1	8.6	8.7	8.9	8.7	9.7	10.0	12.32	10.18
31. Quarterly Pop. Est.	mil.	23.16[b]	23.22[b]	23.28[b]	23.34[b]	23.16[b]	23.39[b]	23.44[b]	23.50	23.55	

[a] Seasonally-adjusted at annual rates.
[b] Revised.
[c] Preliminary.
[d] Excludes Newfoundland.
[e] Based on current initial prices only for wheat, oats, and barley in Alberta, Saskatchewan, and Manitoba.
[f] Excluding repair parts.
[g] NA = not available.

NOTES

HIGHLIGHTS OF CANADIAN AGRICULTURAL TRADE, 1978

This note was prepared for CFE by R. Danielson, International Trade Policy Division, Policy, Planning and Economics Branch, Agriculture Canada. Figures used for 1978 are preliminary.

The value of Canadian agricultural exports increased 13.2 percent from $4,265 million in 1977 to a record $4,830 million in 1978. Agricultural imports showed a similar growth of 12.8 percent, increasing from $3,556 million to $4,013 million, reflecting higher prices for fruits and vegetables, meats, and vegetable oils and the decline of the Canadian dollar during 1978. The surplus in the balance of agricultural trade in 1978 increased 15 percent to $817 million from $709 million in the previous year, although remaining below the 1976 level of $861 million.

In 1978 Canada's three major export markets - Japan, the United States, and the European Economic Community (EEC) - account for 53 percent of export trade, compared with 57 percent in 1976 and 55 percent in

TABLE 1. EXPORTS OF AGRICULTURAL PRODUCTS, 1976, 1977, AND 1978

Commodity	Quantity			Value		
	1976	1977	1978	1976	1977	1978
		'000 tonnes			$ million	
All Commodities	–	–	–	37,576	43,506	51,719
Agricultural Products	–	–	–	3,994	4,265	4,830
Grains	15,805	17,670	18,647	2,365	2,214	2,380
Wheat	10,552	14,268	14,417	1,720	1,826	1,910
Barley	4,329	2,790	3,569	542	312	380
Grain Products	–	–	–	202	206	263
Wheat Flour	507	476	652	130	115	152
Animal Feeds	–	–	–	109	125	122
Oilseeds	1,114	1,478	1,852	283	441	543
Flaxseed	247	329	410	66	94	102
Rapeseed	775	1,028	1,208	186	310	370
Oilseed Products	177	301	325	48	102	102
Animals, Live	–	–	–	120	135	195
Meats	127	130	149	207	222	308
Beef, Veal	40	36	31	58	54	64
Pork	36	43	53	93	116	172
Other Animal Products	–	–	–	205	258	302
Dairy Products	124	210	184	61	92	92
Cheese	2	2	2	6	5	6
Skim Milk Powder	98	166	123	45	70	56
Fruit and Nuts	70	77	95	31	44	67
Apples	45	48	56	13	17	26
Vegetables	207	225	196	71	85	76
Turnips	37	37	34	5	6	5
Dried Beans	61	71	32	26	29	12
Dried Peas	21	30	28	5	9	9
Carrots	25	24	27	3	4	6
Potatoes and Products	256	200	152	46	33	26
Potatoes, Table	132	86	48	17	10	5
Potatoes, Seed	100	99	92	18	17	14
Tobacco	26	24	33	63	64	100
Other Agricultural Products	–	–	–	183	244	254

TABLE 2. IMPORTS OF AGRICULTURAL PRODUCTS, 1976, 1977, AND 1978

Commodity	Quantity			Value		
	1976	1977	1978	1976	1977	1978
	'000 tonnes			$ million		
All Commodities	–	–	–	37,444	42,156	49,684
Agricultural Products	–	–	–	3,133	3,556	4,013
Grains	870	625	501	122	82	84
Corn	792	546	419	95	54	47
Grain Products	–	–	–	57	77	79
Animal Feeds	–	–	–	34	32	43
Oilseeds	469	382	406	126	147	154
Soybeans	397	318	324	81	99	91
Oilseed Products	557	520	572	190	226	263
Oils	186	147	142	110	123	147
Oilcakes and Meal	351	354	414	70	91	103
Animals, Live	–	–	–	89	30	56
Meats	216	175	152	335	295	331
Beef, Veal	95	56	66	134	88	148
Pork	83	85	48	145	149	111
Mutton and Lamb	15	13	14	19	19	26
Other Animal Products	–	–	–	187	199	231
Wool	9	8	9	30	34	39
Dairy Products	28	29	33	57	64	78
Cheese	23	22	21	52	58	66
Fruit and Nuts	1,447	1,427	1,434	546	649	818
Bananas	239	231	236	59	67	75
Oranges	312	341	261	60	72	88
Vegetables	894	870	903	289	360	413
Lettuce	189	193	193	37	38	59
Tomatoes	118	112	122	49	58	56
Potato Products	208	262	177	29	37	33
Sugar	932	1,095	1,057	275	230	211
Coffee	79	68	77	197	344	324
Other Agricultural Products	–	–	–	600	784	895

1977. Japan remained Canada's most important single country market in 1978, importing $833 million, 17 percent of total exports compared with 18 percent in 1977. The United States, Canada's second largest export market, imported commodities valued at $789 million or 16 percent of total agricultural exports, the same share as in 1977. The EEC imported commodities valued at $920 million, representing 19 percent of total agricultural trade in 1978, compared with 21 percent in 1977. The United States continued to be the major source of imported farm products with trade from that country, increasing 12.3 percent to $2,300 million in 1978, up from $2,048 in 1977. The share of imports supplied by the United States was about 58 percent in both 1977 and 1978.

Exports

Canada's leading exports in 1978 were wheat ($1,910 million); barley ($380 million); rapeseed ($370 million); furs, hides, and skins ($191 million); animal feeds ($122 million); and live cattle ($165 million). Grains accounted for 49.3 percent of farm exports, slightly less than in the previous year. Exports of dairy products, at $92 million, remained unchanged from the 1977 level, with reduced sales of skim milk powder being offset by larger sales of evaporated milk. Significant export gains were also achieved for fruits, tobacco, and maple products although vegetable and potato exports declined.

By volume, Canada exported 14.4 million tonnes of wheat in 1978, up marginally from 1977 levels and a 38-percent increase from 1976 levels. Barley exports increased 28 percent from 1977 levels to 3.6 million tonnes, although remaining below the 1976 level of 4.3 million tonnes. The volume of rapeseed exports increased sharply by 56 percent from 1976 levels to 1.2 million tonnes. The volume of fresh and frozen beef and veal exports declined 23 percent during 1976-78 to 31,000 tonnes, while exports of fresh and frozen pork recovered in 1978, increasing 47 percent to 53,000 tonnes. Against the background of reduced supplies, there was a decline in the volume of skim milk powder exports, which fell 26 percent from 1977 export levels to 123,000 tonnes in 1978, although remaining above 1976 levels. Exports of potatoes and products decreased 41 percent to 152,000 tonnes to more normal levels, following the sharp increase in 1977 due to the European drought.

Imports

Fruits and nuts were the leading imports in 1978 at $818 million, an increase of 26 percent from $629 million in 1977. Plantation crops (including tea and coffee) were valued at $716 million, up 4.4 percent from 1977 levels. Other imports, in descending order of importance, were vegetables (including potato products) at $446 million (an increase of 12 percent from 1977 levels), meats at $331 million (up 12.2 percent), oilseed products at $263 million (up 16.4 percent), and sugar at $211 million (down 9.2 percent).

By volume, Canada's imports of most agricultural commodities remained stable during the 1976-78 period. However, corn imports, at 419,000 tonnes, were down significantly from 1977 levels and down 47 percent from 1976 levels, reflecting increased domestic production of grain corn. There were also declines in the volume of beef and veal imports (down 31 percent from the exceptionally high level in 1976), pork imports (down 42 percent from 1976 levels), and imports of fresh oranges (down 24 percent from 1977 levels). Oilcake and meal imports increased by 17 percent to 414,000 tonnes in 1978.

Canada-U.S. Agricultural Trade

The two-way Canadian agricultural trade with the United States reached new highs in 1978. Canadian exports increased 13.5 percent from $695 million in 1977 to $789 million, while imports increased 12.3 percent from $2,048 million in 1977 to $2,300 million. About 16 percent of total Canadian exports have gone in recent years to the United States. In 1978 the relative decline in the Canadian dollar compared with the U.S. dollar made Canadian slaughter and feeder cattle attractive to U.S. buyers; hence exports remained strong throughout 1978. Since 1974 Canada has been a net importer of pork from the United States; however, Canada's net trade balance in pork with all countries showed a surplus of $61 million in 1978.

FARM IMPROVEMENT LOANS

Agriculture Minister Eugene Whelan and Finance Minister Jean Chrétien recently announced the transfer of the Farm Improvement Loans program from the Department of Finance to Agriculture Canada, effective April 1, 1979.

The Farm Improvement Loans program provides government guarantees for loans made to farmers by banks and other designated lenders for a wide variety of purposes.

The Farm Development Division of Agriculture Canada's Food Production and Marketing Branch will administer the program. The program will give the department an important means of assistance in farm financing.

During 1978, 25,710 loans were made for a total of $222.3 million. This is a major increase from the 1977 total of $132 million. Since it was first introduced in 1945, $3,888 million in loans has been guaranteed under the program.

PERSPECTIVES ON NATURAL RESOURCES SYMPOSIUM III, WATER

The third in an annual series of symposia on Perspectives on Natural Resources, Water, will be held on November 6, 7, and 8, 1979, at Sir Sandford Fleming College. This series attempts to assess the roles of the private and public sector in the wise use and management of our natural heritage. For further information please write to Sir Sandford Fleming College, Frost Campus, P.O. Box 8000, Lindsay, Ontario, K9V 4S6, or telephone (705) 324-9144.

PUBLICATIONS

1976 Census of Canada: Agricultural Graphic Presentation. Statistics Canada. 1979. 135p. Catalogue No. 96-871. *Available for $6.00 (in Canada) from Publications Distribution, Statistics Canada, Ottawa, Ontario, K1A 0T6.*

Statistics Canada has published a 135-page book containing not a single statistical chart or table – a farming "atlas" of Canada. The Agriculture Graphic Presentation represents an effort to render the findings of the bureau in a way that will communicate with the general public as well as the specialist. At the same time it makes possible assimilation of often complex data at a glance.

Its 114 color and black-and-white maps have been compiled by the statistical bureau's computerized graphics facilities in cooperation with other departments and institutions.

Many of the maps draw on information not previously published in printed form. Even previously published data are presented in a more detailed way. For example, data reported earlier about an overall increase in Canada's cropland and improved land now pinpoint increases and decreases by county.

Among the findings that emerge from the graphic presentation of data are as follows:

> Heavy concentration of farmland on the Prairies and along the Windsor-Quebec axis contrasts with relative sparsity in British Columbia and the Maritimes.
>
> Large decreases in cropland have occurred in unexpected areas such as Saskatchewan. The decreases are offset, however, by increases in summer fallow.
>
> Farms with high-average yearly sales of $25,000 to $75,000 appear uniformly across the Prairies, Ontario, and Quebec but are rare in British Columbia and the Maritimes.
>
> Farms with sales of $75,000 and more are found with surprising frequency in southern Ontario and somewhat less then expected on the Prairies.
>
> Corn for silage is cultivated along the Windsor-Quebec axis, with minimal output in the rest of the country.
>
> Hay production occurs nationwide but is especially intense in Quebec.
>
> Heavy concentration of soybean production is noticeable in the southern-most tip of Ontario, with no measurable production elsewhere in the country.
>
> Sunflower seed production is concentrated in southern Manitoba's Mennonite area.
>
> Isolated concentrations of potato growing occur in Prince Edward Island, New Brunswick, Quebec, Ontario, Manitoba, and Alberta. Decreases are evident in New Brunswick and Alberta, an increase in Prince Edward Island, some westward shift in Manitoba, and a northward shift in Ontario.
>
> Vegetable production is concentrated in Quebec and Ontario, with little on the Prairies and less in central British Columbia than might be expected.
>
> Concentrated tree-fruit production occurs in the Owen Sound area of Ontario and the Granby-Magog area of Quebec as well as in the well-known centers of the Annapolis Valley, the Niagara Peninsula, and the Okanagan Valley.

The publication depicts the number of farms, land use, farms by annual sales, farms by land area, farms by product, field crops, horticultural crops, livestock and poultry, farm machinery and equipment, farm population, tenure and residence, off-farm work, age of operators, farm labor, and value of land and buildings.

Proceedings of the P.E.I. Conference on Ecological Agriculture. The Institute of Man and Resources. The Ark Project. 1979. *Available for $7.00 from the Institute of Man and Resources, 50 Water Street, P.O. Box 2008, Charlottetown, Prince Edward Island, C1A 1A4.*

The P.E.I. Conference on Ecological Agriculture, jointly sponsored by The New Alchemy Institute (P.E.I.) and The Institute of Man and Resources, and supported by the P.E.I. Department of Agriculture and Forestry, attracted as guest speakers international experts on ecological agriculture.

Readers should find the practical experience and research results contained in the proceedings of particular interest. Included are the following articles:

> Ecological Agriculture in the United Kingdom: Practical Experience, Sam Mayall, Shropshire, England;

Forest Farming, Dr. Steve Manley, Director of Operations, Forestry Branch, P.E.I. Department of Agriculture and Forestry;

The Commercial Imperative and the Decline of the Family Farm, Wendell Berry;

35 Years of Ecological Dairy Farming, Harvey Considine;

Food Processing and Agriculture, Dr. Ross Hume Hall, Medical School, McMaster University;

An Extension Agronomist Views Ecological Agriculture, Winston Way, University of Vermont;

Biological Agriculture in Europe, Chaitanya York, Maine Organic Farmers and Gardeners Association;

Notes on Agriculture in China, Pat Sackery;

Soil Testing and Chromatography, Robert Parnes, Woods End Laboratory, Temple, Maine;

Farm-Scale Composting, Richard and Sharon Thompson;

Soil, Feed Quality and Animal Health, Dr. John Wittaker; and

Biological Approaches to Pest Control, Dr. Stuart Hill, Macdonald College, McGill University.

Also included are opening remarks by the Hon. A.E. (Bud) Ings, DVS, Minister of Agriculture and Forestry, Prince Edward Island, and Dr. Lloyd MacLeod, Director, Agriculture Canada Research Station, Charlottetown.

The following two publications are available free from the Publications Manager, Policy, Planning and Economics Branch, Agriculture Canada, Room E-152B, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.

Canada's Trade in Selected Manufactured Agricultural Production Inputs, 1945-77. Edward Suen, February 1979. 43p.

Commodity Forecasting Models for Canadian Agricutlure, Volume II. Z.A. Hassan and H.B. Huff. December 1978. 131 p. A technical publication.

The following two publications are available free from the Department of Agricultural Economics, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0.

The Canadian Wheat Economy: Economic Implications of Changes in the Crowsnest Pass Freight Rates. J.G. Nagy, W.H. Furtan, and S.N. Kulshreshtha. January 1979. 60p.

A Monthly Forecasting Model of the Beef Cattle-Calves Sector in Canada. K.A. Rosaasen, S.N. Kulshreshtha, and G. Yu. January 1979. 113p.

The following two publications are available free from Alberta Agriculture, 9718-107 St., Edmonton, Alberta, T5K 2C8.

A Consensus of Costs and Returns - Spring Wheat, Durum Wheat, Winter Barley, Rapeseed and Summer Fallow on a 1800-Acre Farm in the Warner District, Southern Alberta. A.G.N. Van Deurzen. January 1979. 13p.

A Consensus of Costs and Returns - 150 Cow-Calf Enterprise, Cardston District, Southern Alberta. A.G.N. Van Deurzen. December 1978, 47p.

Canadian Grain Exports, Crop Year 1977-78. *Available free from the Canadian Grain Commission, 609-303 Main Street, Winnipeg, Manitoba, R3C 3G7.*

Dairy Farm Management Practices and New York Dairy Farm Incomes. C.A. Bratton. January 1979. 32p. *Available from the Department of Agricultural Economics, Cornell University, Ithaca, New York, 14853.*

An Economic Comparison of Alternative Selling Methods for Slaughter Cattle in Ontario. L. Martin, R.R. Richards, and W.R. Usborne. January 1979. 74p. *Available free from the Department of Agricultural Economics and Extension Education, University of Guelph, Guelph, Ontario, N1G 2W1.*

Economics Information - Winter Wheat Production in Ontario. G.A. Fisher. November 1978. 39p. *Available free from the Ontario Ministry of Agriculture and Food, Queen's Park, Toronto, Ontario, M7A 1B7.*

Proceedings, 59th Annual Meeting, Meat Packers Council of Canada. February 1979. *Available free from the Meat Packers Council of Canada, 5233 Dundas Street West, Islington, Ontario, N9B 1A1.*

Starting a Farm in Canada. 1979. 68p. *Available free from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

Statistics 1978, Federal Farm Credit. 1978. 57p. *Available free from the Farm Credit Corporation, 2255 Carling Ave., 6309 Postal Station "J", Ottawa, Ontario, K2A 3W9.*

IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we shall try to accommodate you.

When forwarding your "In Reply" or letter, indicate if we may publish your comments in a subsequent issue.

Sam Woods, Head of the Geography Department at Orchard Park Secondary School, Stoney Creek, Ontario, L8E 2R1, found T.C. Gunn's article, "Part-Time Farming in Nova Scotia," in our October issue, suitable as background material in discussing Maritime agriculture with a grade nine geography class. He also said that there were "some very useful statistical charts in this issue. Much of the data in the issue was not readily available for use in a classroom situation."

Richard E. Preston is a geography professor at the University of Waterloo, Waterloo, Ontario, who also finds CFE articles valuable in his work. Besides liking the Gunn article and "Economic Analysis of Crop Rotations in Western Canada," by L.M. Johnson, in our October issue, he writes that there are "numerous articles from other issues of Canadian Farm Economics. . .valuable both for their findings and for the examples they provide."

Dr. Eric Gibbons, Senior Marketing Advisor, National Livestock Development Authority, Majutetnak, Jalau Selangor, Petaling Jaya, Malaysia, gave a 10 to S.C. Thompson's article, "Management for Increased Productivity in Dairy Farming," in our October issue. He believes that the article is a first rate job and that it gets to the root of all major dairy farm production problems. Dr. Gibbons also noted that it has significant value for countries like Malaysia.

H. James Harrold, an economic geographer, 317 Laird Drive, Toronto, Ontario, found the Zentner and Lindwall article, "An Economic Assessment of Zero Tillage in Wheat-Fallow Rotations in Southern Alberta," in our December issue, useful. He said that "there is no shortage of interesting topics explored in CFE, yet because of the scale of investigation, problems as to usefulness exist. For instance, 'Farmers Participation in Registered Retirement Savings Plans,' by F.L. Tung and R.S. Rust, in the December issue, explores at length the nature of and reasons for farmers' participation in RRSPs across Canada as if the trends discovered occurred without variation *ad mare usque ad mare.* Considerable more 'use' would result from isolating provincial and *even regional* trends of such behaviour which could be expected to exist given the varying roles and perceptions of banks, credit unions and other financial institutions."

Elmer Allen, an economist with UNIFARM, 9934 - 106 St., Edmonton, Alberta, T5K 1E1, thought that the Zentner and Lindwall article and "Margins in the Dairy Processing Industry," by M.F. Konecny and S.C. Thompson, in our December issue were "very good." He said that the Tung and Rust article, however, was "fair." "The data were not up-to-date (latest year used was 1974). The article did not do a good job of explaining the relationship of income and tax saving. More research was needed. Information was available to me from other sources some time ago. However, the breakdown of this article did have more detail. I suggest that findings of more current data, to relate higher incomes in 1975, '76, and '77 would be more interesting as well as the use of spousal plans for splitting income! My findings have been that RRSPs are used to average the tax burden and not for tax savings!"

Dr. P.J. Thair, Professor of Agricultural Economics, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0, is pleased to have the page of Economic Indicators, "especially with the demise of Statistics Canada's *Quarterly Bulletin of Agriculture Statistics.*"

IN REPLY TO AUTHORS AND EDITORS REGARDING JUNE 1979 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) Forecasting Farm Credit Requirements for 1981
(2) Energy Use in the Canadian Horticultural Crop and Food System
(3) Farm Machinery Retailing in Canada

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

not useful ______________________________ very useful
1 2 3 4 5 6 7 8 9 10

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr., Ms., or Dr.) ______________________________ Occupation ______________
(Please Print)

ADDRESS ____

Please return the above to:

Earl Love, Managing Editor, Canadian Farm Economics
Information Services
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
Canada
K1A 0C5

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

VOLUME 14 NUMBER 4 AUGUST 1979

CANADIAN FARM ECONOMICS

Agriculture Canada

HON. JOHN WISE, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

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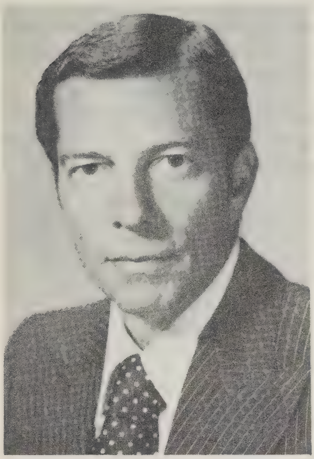
Letters from readers: Letters are encouraged and should be addressed to the editor. Comments and suggestions are useful to editors and authors for effective two-way communication. Edited letters will be used in CFE with the writer's permission.

INTRODUCING AGRICULTURE MINISTER JOHN WISE



Hon. John Wise

The editors of Canadian Farm Economics take pleasure in introducing to their readers Agriculture Minister John Wise.

Mr. Wise, a fifth-generation dairy farmer, was born in 1935 in Yarmouth Township, Elgin County, Ontario, and is still a resident in his Elgin constituency. He and his wife, the former Ann Richardson, and their two children, live on a farm near St. Thomas.

The agriculture minister attended St. Thomas and Elgin public schools and graduated from the University of Guelph in 1956.

In 1957 Mr. Wise became the youngest president of Elgin Jersey Breeders to ever hold office. Three years later, he was elected Elgin director of the Oxford and District Cattle Breeders' Association, and in 1965 was elected president of the organization.

The minister was acclaimed as the youngest reeve of Yarmouth Township in 1968, and the following year became warden of Elgin County. He has since served as vice-chairman and chairman of the Central Elgin Planning Board and director of Elgin Co-operative Services.

Mr. Wise was first elected to the House of Commons for Elgin riding in the general election of October 30, 1972. In Parliament he served as dairy critic under Opposition Leader Robert Stanfield. In 1974 he was re-elected in Elgin, and under Opposition Leader Joe Clark, served as chairman of the Progressive Conservative Caucus Committee on Agriculture.

Through speeches and news releases since his appointment, Agriculture Minister Wise has emphasized the importance of agriculture to the Canadian economy. Mr. Wise's interest in agricultural economics is evident in his recent appointment of Douglas Campbell as his executive assistant. Mr. Campbell has an economics degree as well as a bachelor of science degree in agriculture from the University of Saskatchewan (Saskatoon).

Mr. Wise believes strongly in the team approach in dealing with the complexities and concerns of Canadian agriculture, and he intends to put a strong emphasis on communication – between every sector of the agriculture and food industry and the federal bodies that serve them. The minister will also seek the opinions and cooperation of other government departments and provincial and federal organizations to make the best use of every possible opportunity and resource. What is most important, Mr. Wise envisions Agriculture Canada providing the leadership in a team approach to improve Canada's Agriculture and food industry.

Mr. Wise intends to give top priority to better communication with the provinces and intends to take full advantage of the Federal-Provincial Relations Division (and its chief liaison officers), set up by Agriculture Canada last year. This division provides provincial representation in Ottawa, and explains the federal point of view and provides information on Agriculture Canada in the provinces.

One area in which the minister believes a great challenge exists is in the much needed expansion of Canada's exports. He has urged that our agricultural industry take advantage of the new, improved, and more secure export market opportunities created by the recently-completed Multilateral Trade Negotiations (MTN). (For details see *Notes* in this issue.)

In a recent press release, Mr. Wise stated: "After six years of tough bargaining, the negotiations are completed. But now the real action must begin. Tariff cuts on their own do not generate trade. It is now up to Canadian farmers, processors, and exporters to translate these opportunities into cash sales."

The minister also pointed out in an address that "the

end of the MTN isn't the *end* of anything. It is, rather, the springboard from which we can, with planning, and effort, continue to expand our export market opportunities. And we must do this for the sake of our industry, and for the sake of our country's economic survival. Most of all, we have a responsibility for the continuing strengthening of the food chain's key link – the primary producer."

Mr. Wise believes that Agriculture Canada is in a good position to act as coordinator of a solid team approach in seeking out new markets and fresh potentials.

"The MTN results, combined with a favorable exchange rate, present Canadian agriculture with an opportunity we cannot afford to miss if we are to maximize agriculture's production potential."

We are confident that the readers of Canadian Farm Economics will grasp the opportunity of working with Mr. Wise in this cooperative endeavor.

THE CHEESE INDUSTRY IN CANADA

V. McCormick*

The cheese industry is one of the expanding sectors of the Canadian dairy industry. Cheese consumption, contrary to the trend in most other dairy products, has been increasing since 1920. This upward trend is expected to continue. The increase in consumption of whole milk cheese other than cheddar has been dramatic. As a result of the Multilateral Trade Negotiations Canada will have freer access to the U.K. market for aged cheddar.

HISTORY OF THE INDUSTRY BEFORE 1950

The cheese industry played a very important part in Canada's early economic development and it continues to play an important role in our agricultural sector. There is mention of cheese being exported from the Kingston, Ontario, area (presumably to the United States) as early as 1801. The factory system of making cheese and butter was introduced throughout the world's dairy countries from 1860 to 1885 and Canada was in a favorable position to take advantage of this technological breakthrough. The U.S. market for Canadian grain and cattle had been cut off by the abrogation of reciprocity in 1866 and farmers had to look for alternative enterprises. There appeared to be a good opportunity for dairying as a new industry. Britain, which had emerged as a world leader in industrial development, was a good market outlet for dairy products. In the late 1890s ships began installing cold storage facilities, enabling butter and cheese to be shipped without deteriorating. Canada also had preferred access to the British market.

The first cheese factory (*The Pioneer*) was established in Oxford County, Ontario, in 1864. The number of factories increased rapidly and by the year of Confederation there were more than 200 in Ontario alone. Cheese was a relatively inexpensive source of high quality food and once the dairy industry became soundly established, Canada supplied large quantities of cheese to Britain to feed an expanding industrial population.

During the century that followed Confederation, Canada exported an average of approximately 43 500 t of cheddar cheese a year, with a record high of 106 142 t in 1904. Until 1947, over half the cheese produced in Canada was exported. After World War II, currency restrictions in the United Kingdom curtailed Canada's exports, which never again reached the levels of the early 1940s. Unfortunately, exports have fallen to very low levels in recent years, largely because of price competition and trade barriers.

During World War II, Canadian producers took advantage of continental European exporters being cut off from their traditional market in the United Kingdom. Cheddar output climbed to 93 500 t in 1942 but by 1948 it had fallen to 40 380 t, the lowest level since the 1880s. In the late 1940s and early 1950s, prices for cheese were low compared with other dairy products which were in demand from countries other than the United Kingdom. This caused a shift away from the production of cheddar to products such as evaporated and powdered milk.

CHEESE PRODUCTION

Cheese production is usually reported for the two main categories – cheddar and "other" cheese made from whole milk. Processed cheese is a cheese-based product made from cheddar or cheeses similar to cheddar, such as Colby. Cottage cheese is made from skim milk, with

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*V. McCormick is an economist with the Commodity Market Analysis Division, Policy, Planning and Economics Branch, Agriculture Canada, Ottawa.

cream added to the manufactured product for creamed cottage cheese, and is considered a fresh dairy product. About 1 000 t of skim milk cheese, a firm cheese made with skim or partly skim milk, is currently produced annually. Cheese is also made from whey, a by-product in the cheese production process. Ricotta cheese is basically a heat-coagulated whey protein.

Cheddar cheese production has expanded in all regions of Canada since 1950, largely as the result of domestic demand, with the greatest volume increase occurring in Quebec. Ontario, which historically had been the leading producer, has not increased significantly its cheddar output since the 1950s, although there was an upward movement in production in the second half of the 1960s because of export demand. Quebec is now the largest cheddar producer, with Ontario taking second place. Ontario and Quebec together produce more than 80 percent of the national cheddar output.

The expansion of cheddar production in Quebec has been remarkable. It increased from a yearly output of 6 800 t in the five-year 1950-54 period to 37 250 t in 1974-1978, an increase of about 450 percent. This increase is largely attributed to the consolidation or upgrading of existing cheese factories (or both), the construction of modern facilities, and a substantial increase in total milk output. Total Canadian cheddar cheese production in 1978 was 80 535 t (Table 1). It is estimated that over 40 percent of the cheddar cheese produced is used in manufacturing processed cheese.

Growth in the output of whole milk cheese other than cheddar in Canada has been phenomenal, rising from 2 300 t in 1950 to a high of 59 300 t in 1978 (Table 2). Output in the past six years alone has risen from 27 190 t in 1973 to 59 300 t in 1978, or 118 percent. Growth in the specialty cheese market is expected to continue. An expansion of this large output would probably not have occurred had Canadians not been introduced to the various specialty-type cheese from other countries through imports. Immigrants from European countries such as Italy, Portugal, the Netherlands, etc., created a demand for specialty-type cheese.

Many of the varieties imported were not produced in Canada because it was uneconomic in view of the small volumes involved. Factories were geared to cheddar production. In recent years the capacity of the Canadian dairy industry for producing other whole milk cheese has expanded greatly. There are 108 plants currently producing specialty-type cheese in Canada. Over 60 varieties, including processed types, were manufactured in 1978; of the total volume 45 percent was Mozarella and 11 percent Pizza. Varieties include such exotic names as Scamozza, Amfrom Cacciocavallo, Camembert, Maigrelet, Gruyère, Burrini, Formaggio, and Chantelle.

DOMESTIC DISAPPEARANCE

Per capita cheese consumption, contrary to the trend in consumption of most dairy products, has been increasing since 1920, when the first official consumption records were started. Total domestic disappearance of cheddar in 1978 was 79 211 t, an increase of nearly 200 percent from the 27 030 t consumed in 1950. On a per capita basis cheddar increased from 1.97 kg in 1950 to 3.37 kg

TABLE 1. CHEDDAR CHEESE, SUPPLY AND DISPOSITION, CANADA, 1950-78

						Domestic Disappearance	
Year	Stocks on Jan. 1	Production	Imports	Total Supply	Exports	Total	Per Capita
	—		'000 tonnes			—	— kg —
1950	19.84	44.29	3.00	67.13	28.52	27.03	1.97
1960	23.83	50.06	0	73.89	8.42	40.18	2.25
1970	36.68	75.16	0	111.84	13.57	70.69	3.32
1971	27.58	86.53	0	114.11	13.31	71.99	3.33
1972	28.81	87.13	0	115.94	8.34	74.91	3.43
1973	32.69	85.69	0	118.38	2.65	84.68	3.84
1974	31.05	88.16	0	119.21	1.42	85.84	3.83
1975	31.95	79.78	—[a]	111.73	1.21	80.88	3.56
1976	29.64	78.01	—[a]	107.65	0.95	81.70	3.55
1977	25.00	80.36	—[a]	105.36	0.74	76.62	3.26
1978	28.00	80.53	—[a]	108.53	0.63	79.21	3.37
1979	28.69	—	—	—	—	—	—

[a]Less than 454 000 kg; included with "Other" cheese imports.

Source: Statistics Canada.

in 1978, a rise of 71 percent. There have been year-to-year fluctuations due largely to year-end stock reporting.

Consumption of other cheese made with whole milk has been even more dramatic than that of cheddar, climbing from less than 4 000 t in 1950 to 76 520 t in 1978. Total consumption of other cheese in 1978 was 19 times greater than in 1950. Per capita consumption rose from 0.29 kg in 1950 to 3.26 kg in 1978.

Cottage cheese, made from skim milk, has been the Cinderella product of the dairy industry. Consumption has risen more than seven-fold from 3 652 t in 1950 to 26 235 t in 1978. Per capita consumption grew from 0.27 kg in 1950 to 1.12 kg in 1978, a 300-percent increase. There is a wide variation in regional cottage cheese consumption patterns, with Ontario, British Columbia, and Alberta being the largest consumers. Quebec has never been a large consumer of cottage cheese, although consumption levels for other cheese have been high in that province.

In recent years the expansion in per capita cheese consumption appears to have been associated with higher living standards, a greater sophistication in consumer tastes, and more awareness of good nutrition. There seems to be opportunity for still greater expansion in per capita consumption, although the rate of increase may be smaller than the dramatic growth during the past decade. Much will depend on consumer incomes; the prices of alternate protein products, such as meats; and the dairy policy. The direct federal subsidy to farmers for industrial milk and cream has enabled the prices of dairy products, including cheese, to be raised less in relation to given producer support levels.

TRADE

Exports

Export demand for Canadian cheddar, largely to the United Kingdom, was relatively brisk from 1962 to 1971 when annual cheddar cheese exports averaged 13 800 t. The United Kingdom's entry into the EEC in 1973 imposed a high import levy which virtually closed that market for two years. As the result of concern over the loss of traditional exports to the U.K. market, an agreement for special access terms for Canadian cheddar was reached between the EEC and Canada in 1975.

Despite this agreement the total export market for Canadian cheddar has been very small. The agreement provided for a fixed import levy of 15 units of account (u.a.) per 100 kg, or 18.74 cents a kg at exchange rates existing at the time. At the inception of the agreement, the levy was abated in full to ensure that the higher prices to the U.K. consumers, as a result of the imposition of EEC agricultural and other levies, would only come into effect gradually. The levy came into full effect by 1977-78. Expanding milk production in recent years in the EEC, resulting in increased cheese output, has been a factor in reducing Canada's exports.

Canada's cheddar cheese exports in 1978 were 630 t, the lowest level in this century. However, the export picture for 1979 and 1980 looks considerably brighter.

Canada has obtained freer access to the EEC market for cheddar as a result of the Multilateral Trade Negotiations within the framework of the General Agreement on Tariffs and Trade (GATT) concluded at Geneva in April 1979. The latest agreement, to become effective on January 1, 1980, establishes an annual quota of 2 750 t for aged Canadian cheddar at least nine months old. A fixed import charge or levy of 10 European units of account per 100 kg (18.08 cents Canadian per kg at July 11, 1979 currency levels) will be assessed.

Minimum import prices apply to all package sizes. Canadian cheddar entering the United Kingdom must not be priced below the following minimum standards:

- blocks and rounds, 10 kg or above, 170 u.a. per 100 kg,
- retail packs, 500 g or above, 185 u.a. per 100 kg, and
- retail packs, less than 500 g, 195 u.a. per 100 kg.

The EEC has undertaken to adjust minimum import prices to ensure full use of the 2 750-t quota.

The United States is a natural market for Canadian cheese, but exports to that country are largely limited by quota restrictions. In 1953 the United States imposed import quotas on certain dairy products to prevent interference with their price support program for milk and butterfat. The initial annual quota for cheddar-type cheese from all countries was about 1 261 t, with Canada's share as a traditional exporting country at 238 t. Canada currently has a quota to the United States of 555.7 t for aged, unpasteurized cheddar and 277.8 t for other cheddar.

There is also a quota of about 1 211.1 t of "other" cheese, excluding Swiss or Emmenthaler and Gruyère, if the export prices are under the "price-break." (The price-break is the U.S. support price per pound for cheddar cheese rounded to the nearest cent plus 7 cents.) Other Canadian specialty-type cheeses can be exported to the United States above the price-break if there is a market for cheese at such prices. Varieties which Canada have been exporting recently to the United States above the price-break include Mozzarella, Feta, Provolone, and Quark.

As a result of the GATT negotiations, the United States is imposing more restrictive measures on cheese imports. Canada's traditional cheese exports under quota to the United States will likely continue but there will not be

TABLE 2. OTHER CHEESE,[a] SUPPLY AND DISTRIBUTION, CANADA, 1953-78

Year	Stocks on Jan. 1	Production	Imports	Total Supply	Exports	Domestic Disappearance Total	Domestic Disappearance Per Capita
	–		'000 tonnes			–	– kg –
1953	0.54	2.93	2.37	5.84	0	5.40	0.36
1960	1.46	5.61	5.97	13.04	0.02	11.03	0.62
1970	2.54	22.48	12.28	37.30	1.40	32.65	1.53
1971	3.25	25.97	13.76	42.98	0.75	37.84	1.75
1972	4.39	26.01	14.90	45.30	1.06	38.74	1.77
1973	5.50	27.19	17.31	50.00	2.58	41.66	1.89
1974	5.76	41.83	20.26	67.85	2.14	59.66	2.66
1975	6.05	40.88	20.19	67.12	0.89	59.87	2.64
1976	6.36	47.45	20.96	74.77	1.28	66.26	2.88
1977	7.23	54.02	19.85	81.10	1.08	71.25	3.06
1978	8.77	59.30	18.98	87.05	1.39	76.52	3.26
1979	9.14	–	–	–	–	–	–

[a]Series incomplete before 1953.

Source: Statistics Canada.

much opportunity for expansion. The quota has not been filled in recent years because of price competition, import licences, and the relatively small quantities of product involved.

Beginning January 1, 1980, Canadian cheese exports to the United States will be subject to an overall quota of 2 044 t for all cheese other than soft, cured cheeses such as Camembert, Brie, and Oka. The quota for aged cheddar is 833 t, which is about equal to the previous quota for all cheddar. The quota for cheese other than cheddar is 1 211 t, including 70 for Swiss type cheeses. The price-break measure now in effect for certain other cheeses will be eliminated. Canada will not be able to export as much cheese other than cheddar as under the present quota with the price-break, with the exception of some of the soft varieties.

A small market for Canadian cheese exists in the Caribbean area.

Imports

In response to consumer demand, Canada's imports of whole milk other than cheddar have been on the upswing since the 1950s, rising from a modest 2 367 t in 1953 to 18 980 t in 1978. In addition, 1 800 to 2 000 t of process cheese is imported annually. About 60 percent of Canada's cheese imports originate in the EEC countries.

Imports of any dairy product for which price support payments are received may be placed on the Import Control List in accordance with the provisions of the Export and Import Permits Act. Cheese has been on the Import Control List for many years. Initially, import permits were issued for natural cheese other than cheddar and Colby for direct consumption and for traditional imports of processed cheese.

Canada established a global import quota for all types of cheese effective June 6, 1975, but retroactive to January 1, 1975. Initially, the quota was on a calendar year basis but was changed to the dairy year effective April 1, 1976. The quota limited imports to approximately 22 700 t a year (1974 imports totaled 20 260 t) with no more than 453 000 kg allocated to cheddar cheese.

The quota was maintained at 22 700 t until the 1977-78 dairy year. With imports limited by quota the increases in cheese consumption were met through expansion in domestic production. However, producer groups and processors protested the size of the import quota, contending that because overall Canadian requirements for industrial milk had declined, the cheese import quota in milk equivalent was occupying an increasingly larger share of domestic needs. As a result, the federal government reduced the cheese import quota for the 1978-79 dairy year, beginning April 1, 1978, to approximately 20 400 t.

World Trade in Cheese

Cheese has become the only significant area of demand growth in most of the important dairy producing countries in recent years. This has been partly due to the increase in demand generated by higher incomes and

to changes in tastes. Moreover, the existence in some countries of large stocks of butter and skim milk powder has resulted in the diversion of milk from the production of these products. Most of the international trade in cheese has been among European countries. The United States, despite import quotas, is the world's largest single importer. Except for Japan, cheese exports to other areas are small, although markets are developing in the Middle East and Asia.

There has been a significant increase in the consumption of cheese varieties other than the cheddar type and this development has stimulated imports even into dairying countries. Cheese exports from the EEC to destinations outside the Community have been the world's largest in recent years. New Zealand is the world's second largest exporter but the quantity is only about a third of the EEC's net exports.

CONCLUSION

The dairy industry is one of the oldest industries in Canada and has been associated with agriculture in all provinces. In 1978, farm cash receipts from the sale of milk and cream amounted to $1,509 million, exclusive of supplementary payments. The whole milk that went into cheese manufacturing represented an estimated $281 million, or 19 percent of the total farm cash receipts from all milk and cream sales. The milk that was used in cheese manufacturing comprised 37 percent of all industrial milk deliveries, excluding farm-separated cream. The 140 million kg of all whole milk cheese produced in 1978 required about 1.536 million tonnes of milk. The cheese industry is expected to continue to be a relatively high growth area within the Canadian dairy industry.

AN ECONOMIC ASSESSMENT OF DRYLAND CROPPING PROGRAMS IN THE PRAIRIE PROVINCES: EXPECTED NET INCOMES AND RESOURCE REQUIREMENTS

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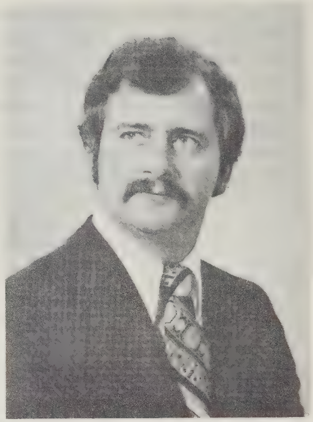

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The principal factors influencing the selection of cropping programs in the different soil-climatic areas of the Prairie Provinces are expected net income, seasonality of resource requirements, and income variability or risk. This article is focused on expected net incomes and resource requirements for case farms in three soil zones. A subsequent article will examine income variability on these farms.

INTRODUCTION

The selection of cropping programs for individual farms depends on three sets of factors. The first set, physical considerations, includes fertility, physical properties of the soil, temperature, rainfall, insects, and disease. These factors determine the substitution possibilities among crops and place some limits on the crops that might be grown and the yields that may be expected.

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Economic considerations comprise the second set of factors. This includes amounts and seasonality of resources required for production, prices of inputs and products, market opportunities, financial position of the farm, and the ability of the farm to withstand major fluctuations in income. These factors provide the criteria on which to base rational decisions by weighing the relative advantage of each crop and service in relation to the goals of the farm. The cropping program that is 'optimal' for an individual farm depends on the relative importance, or weights, attached to these criteria.

The third set of factors, the decision-making and organizational abilities of the farm manager, includes intelligence, skills, management ability, and attitude towards risk. These factors govern the success of the individual farm manager in choosing and directing 'optimal' cropping programs.

In much of Western Canada, and particularly in the more arid areas where precipitation is highly variable, dryland grain farmers have selected cropping programs that generally include high proportions of fallow. The greater moisture reserves after fallow reduce the yield dependency on growing season rainfall (Lehane and Staple 1965). Consequently, yields are usually higher and more stable after fallow than under continuous cropping (Austenson and Khatri 1972).

Aside from greater soil moisture reserves at planting, fallow has other advantages. These include accumulation of plant nutrients resulting from the breakdown of organic materials in the soil, perennial and annual weed control, control of soil-borne plant diseases and insect pests, and more uniform seasonal distribution of labor and machinery requirements (Molberg *et al.* 1967).

Fallowing has some disadvantages as well. Frequent fallowing increases the rate of organic matter oxidation in soils and in the long run may result in lower yields (Lehane *et al.* 1964). Tillage reduces surface residue and exposes the soil surface to wind and water erosion (Anderson 1961). And fallow is a major factor contributing to the development of saline seep areas (Milne and Rapp 1968).

In recent years, technologies have been developed that provide other sources of the beneficial effects of fallow and mitigate some of its disadvantages. New varieties of grain have higher yields and greater resistance to drought, frost, insects, and disease. Large, modern machines facilitate timely operations, effective weed control, surface residue maintenance, and efficient labor and energy use. Chemical seed treatments are available to ensure better seedling survival and early growth. Herbicides and insecticides reduce the incidence and extent of pest damage. Commercial fertilizers replace or supplement nutrients supplied by oxidation of soil organic matter and break-down of primary minerals. Application of these and other technologies may improve the competitive position of rotations that use less fallow.

This study was undertaken to investigate economic aspects of dryland cereal and oilseed rotations on farms in the Prairie Provinces. Three criteria considered important in selecting cropping programs on dryland grain farms in the Prairie Provinces were examined – expected net income, seasonal resource requirements (especially labor), and income variability. This article compares the expected net incomes for various crop combinations and rotations in the Brown, Dark Brown, and Black soil zones for various combinations of input and product prices. It also examines differences in resource requirements among crop combinations, rotations, and soil zones. A subsequent article will examine income variability associated with these cropping programs.

METHOD OF ANALYSIS AND DATA SOURCES

The Canadian Prairie Provinces are characterized by several soil zones in each of which the effects of climatic factors and soil properties on crop production practices and yields are relatively uniform.[1] In general, annual precipitation and risk of frost damage increase whereas evaporation and susceptibility to wind erosion decrease from the Brown to Dark Brown to Black soil zones. These factors are reflected in the existing cropping patterns in each zone and in the cropping alternatives considered in the study.

A farm-level simulation model of dryland crop production was used for the analysis (Zentner *et al.* 1978). The model includes all of the major crops and production methods available in each soil zone. Thus it provides a means for evaluating alternative cropping programs in these zones in terms of seasonal input use, income level and variability, physical output levels, and other performance measures.

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[1] A description can be found in the *Alberta Farm Guide 1976*, Alberta Department of Agriculture, Edmonton, pp. 18-35; or the *1978 Guide to Farm Practice in Saskatchewan*, Saskatchewan Department of Agriculture, Regina, pp. 63-73.

TABLE 1. SUMMARY OF PRICE SITUATIONS EXAMINED

Price Situation									
Grain	N and P[c]	Labor[d]	Winter Wheat	Spring Wheat	Barley	Flax	Rape	Fertilizer	Labor
			—		$/tonne		—	$/kg	$/hr
Av[a]	Med.	Med.	118	121	93	282	241	.35	5.00
Low[b]	Med.	Med.	85	86	71	197	176	.35	5.00
High[b]	Med.	Med.	150	156	116	367	305	.35	5.00
Av	Low	Med.	118	121	93	282	241	.26	5.00
Av	High	Med.	118	121	93	282	241	.44	5.00
Av	Med.	Low	118	121	93	282	241	.35	0.00
Av	Med.	High	118	121	93	282	241	.35	10.00

[a] Average farm-level grain prices for the period 1972-73 to 1976-77.
[b] Low and high grain prices are one standard deviation below and above average prices for the period 1972-73 to 1976-77.
[c] The same unit price was assumed for both N and P_2O_5. Low, medium, and high prices were $.26, $.35, and $.44 a kilogram.
[d] Low, medium, and high labor prices were $0, $5, and $10 an hour.

The analysis considered a five-year period to capture the effects of factors that were dependent on time and use (e.g., machinery replacement). A five-year series of grain and oilseed prices was used. The average results for the five-year period are reported.

Three case farms, one from each soil zone, were selected for analysis. The case farms reflected average farm situations in terms of land area, by the type and age of machinery, and level of management expertise.[2] It was assumed that recommended cultural and tillage practices (e.g., planting dates, seeding rates, herbicide and insecticide use, and tillage frequency and type) were used on the case farms. Prices for variable inputs (except for fertilizer and labor) and capital items were representative of 1978 conditions. Expected net incomes and resource requirements for feasible cereal and oilseed cropping combinations (subject to agronomic constraints) were calculated for three rotations in each soil zone at three prices for grains, three prices for fertilizers, and three prices for labor. Results from seven combinations of these prices are in Table 1. The rotations studied were crop-fallow, crop-crop-fallow, and continuous crop. The product prices used in the study were based on prices received by farmers for cereal and oilseed crops in the Prairie Provinces from 1972-73 to 1976-77 (Statistics Canada 1972-77, 1975). It was assumed that all grain was sold within the crop year in which it was produced.

[2] The case farms for the Brown, Dark Brown, and Black soil zones had 485, 365, and 250 cultivated hectares, respectively. A detailed description of the case farms is available from the authors.

The crops considered for the Brown soil zone were winter wheat, flax, spring wheat, and barley. Winter wheat production was restricted to fallow because of problems with diseases and volunteer grains. Low moisture reserves on stubble often prevent proper seedbed preparation and adequate germination. Flax was restricted to fallow because of low tolerance to drought (Anderson and Read 1966). In addition, flax was limited to 50 percent of the seeded area for the crop-fallow rotation to ensure that adequate plant residue was maintained on the soil surface to prevent wind erosion (Anderson 1966).

In the Dark Brown soil zone the crops considered were winter wheat, rape, spring wheat, and barley. Restrictions placed on winter wheat and oilseed production were similar to those for the Brown soil zone.

In the Black soil zone the crops considered were rape, spring wheat, and barley. No restrictions were placed on the proportion of fallow or stubble seeded to each crop.

Many other feasible and, in some cases, more agronomically suitable crop combinations could have been considered for each soil zone. In particular, combinations that contain two or more crops on both fallow and stubble in the same year could have been included. The results from such combinations can be obtained to a considerable degree by interpolation from those reported.

Data from several Agriculture Canada research stations and universities in Western Canada were used to develop yield equations for the major crops grown on fallow

TABLE 2. EXPECTED GRAIN YIELDS AND OPTIMAL RATES OF NITROGEN (N) AND PHOSPHORUS (P_2O_5) FERTILIZERS IN THE BROWN, DARK BROWN, AND BLACK SOIL ZONES FOR THE AVERAGE PRICE SITUATION

Crop	Yield	N	P_2O_5
	–	kg/ha	–
		Brown Soil Zone	
Winter Wheat – Fallow	2000	7.8	24.7
Spring Wheat – Fallow	1819	5.0	26.9
– Stubble	1118	31.4	21.3
Barley – Fallow	2253	4.5	25.8
– Stubble	1504	35.9	21.3
Flax – Fallow	855	12.3	20.2
		Dark Brown Soil Zone	
Winter Wheat – Fallow	2371	13.5	30.3
Spring Wheat – Fallow	2095	9.0	29.2
– Stubble	1522	46.0	23.6
Barley – Fallow	2630	7.8	28.1
– Stubble	1972	48.3	23.6
Rape – Fallow	1067	11.2	25.8
		Black Soil Zone	
Spring Wheat – Fallow	2405	7.8	33.7
– Stubble	1933	58.4	30.3
Barley – Fallow	3007	9.0	33.7
– Stubble	2447	61.7	29.2
Rape – Fallow	1280	11.2	31.4
– Stubble	893	59.5	24.7

and stubble in each soil zone. Yield equations, where yield was a function of the rates of applied nitrogen and phosphorus fertilizers, were estimated using ordinary least squares regression analysis.[3] They were used to calculate optimal rates of fertilizer input for each crop on fallow and stubble at particular prices for fertilizers and grains.

EXPECTED NET INCOMES

Expected grain yields and optimal rates of nitrogen and phosphorus (as P_2O_5) fertilizers increased from the Brown to the Dark Brown to the Black soil zone (Table 2). Stubble yields, as a proportion of fallow yields, averaged 0.64 in the Brown, 0.74 in the Dark Brown, and 0.80 in the Black soil zone. These results are attributable mainly to differences in precipitation in these areas. The optimal rate of fertilization, and thus estimated grain yields, increased with higher grain prices but decreased with higher fertilizer prices (not shown). Optimal rates of nitrogen fertilizer application on stubble were about six times higher than those on fallow. The response to applied nitrogen fertilizer on fallow was lower because of the build-up of soil nitrogen that occurs during the fallow period (Michalyna and Hedlin 1961).

The expected net incomes for the case farms were estimated on a per-unit-area-of-cultivated-land basis, and varied greatly with the rotation, crop combination, and price situation (Tables 3, 4, and 5). These per-hectare values represent the *average* expected return to owner equity and management for the five-year price series used in the study. They constitute the funds (above all cash costs, depreciation, and labor) available for income tax, interest and principal payments on farm debt, and interest allowance on owned equity. Throughout the remainder of the article, unless otherwise stated, the comparisons are made relative to the best crop combination for each rotation in the average price situation.

[3]The postulated functional form of the yield equations is as follows:

$Y = b_0 + b_1N + b_2P + b_3N^2 + b_4P^2 + b_5N{\cdot}P$

where:

Y = yield on fallow or stubble (kg/ha),

N = nitrogen (N) fertilizer applied (kg/ha),

P = phosphorus (P_2O_5) fertilizer applied (kg/ha), and

b_0–b_5 = coefficients estimated by regression.

TABLE 3. EXPECTED NET INCOME BY CROP COMBINATION AND ROTATION IN THE BROWN SOIL ZONE

Crop Combination[a]	Average[b] Prices	Grain Price		Fertilizer Price		Labor Price	
		Low	High	Low	High	Low	High
	$/ha of rotation						
Crop-Fallow Rotation							
Winter Wheat	52.81[c]	21.66[c]	84.08	54.39[c]	51.55[c]	63.23[c]	42.38[c]
Flax and Winter Wheat	50.59	16.75	85.41[c]	52.19	49.28	61.18	39.99
Flax and Spring Wheat	46.04	12.40	80.42	47.52	44.85	57.08	35.00
Flax and Barley	43.82	13.44	75.06	45.37	42.88	55.18	32.46
Spring Wheat	43.77	13.12	74.15	45.00	42.76	55.06	32.48
Barley	39.30	15.09	63.43	40.75	38.28	51.25	27.34
Crop-Crop-Fallow Rotation							
Winter Wheat (Spring Wheat)	46.24	12.89	79.51	49.00	43.99	58.76	33.72
Winter Wheat (Barley)	47.84	16.35	79.34	50.61	45.60	60.69	35.00
Flax (Spring Wheat)	43.25	6.13	81.26	46.07	40.90	55.99	30.50
Flax (Barley)	44.83	9.56	81.11	47.70	42.53	57.92	31.74
Spring Wheat (Spring Wheat)	40.21	7.04	72.89	42.76	38.14	53.33	27.10
Spring Wheat (Barley)	41.82	10.50	72.74	44.36	39.74	55.25	28.38
Barley (Spring Wheat)	37.20	8.37	65.73	39.89	35.10	50.78	23.61
Barley (Barley)	38.80	11.83	65.55	41.50	36.73	52.68	24.92
Continuous Crop Rotation							
(Spring Wheat)	29.84	−8.10	67.28	35.12	25.54	46.76	12.92
(Barley)	34.65	2.15	66.47	39.62	30.38	52.49	16.82

[a] Crop in brackets was produced on stubble.
[b] Refers to the input and product price combination in the first row of Table 1. Similarly, other columns of this table refer to the price situation in the corresponding row of Table 1.
[c] Refers to the cropping program with the highest expected net income for that price situation.

In the Brown soil zone the expected net incomes for the case farm varied with the particular cropping combination considered (Table 3). The crop combinations with winter wheat generally had the highest expected net income while those with only spring wheat had the lowest. This reflects the relative yields usually achieved with these crops in this zone. Of course, winter wheat would not be a suitable crop in areas where it has not been proven to be winter hardy. The ranking of the individual crop combinations changed as grain or input prices changed because of differences in fertilizer response and labor requirements among crops.

Expected net income was highest for the two-year rotation (crop-fallow) and lowest for the continuous crop rotation under all grain price situations in the Brown soil zone. The relative profitability of the rotations varied considerably with the grain price. Expected net income for the most profitable crop combination in the three-year rotation (crop-crop-fallow) was about 25, 10, and 5 percent lower than for the two-year rotation in the low, average, and high grain price situations, respectively. Expected net income with continuous cropping was about 90, 35, and 11 percent lower than for the two-year rotation in the same situations.

The effects of changes in input and product prices on expected net incomes were greatest for continuous cropping and smallest for the two-year rotation in the Brown soil zone. These reflect the relative differences among rotations in input mix and product output level. With low grain prices expected net incomes were \$31.15, \$31.49, and \$32.50 a hectare lower than with average prices for the two-year, three-year, and continuous crop rotations, respectively. Low fertilizer prices increased expected net incomes \$1.58, \$2.77, and \$4.97 a hectare higher than average prices. Similarly, low labor prices increased expected net income \$10.42, \$12.85, and \$17.84 a hectare. High prices for grain, fertilizers, and labor had an opposite effect of similar magnitude on expected net incomes.

In the Dark Brown soil zone the crop combinations that generally had the highest expected net incomes for the case farm included winter wheat on fallow and barley on stubble (Table 4). The crop combinations with barley on fallow usually had the lowest expected net income. The ranking of crop combinations changed with the price situations considered.

The rank order of rotations and crop combinations was more sensitive to input and product price changes in the Dark Brown soil zone than in the Brown soil zone. This reflects smaller yield differences between fallow and stubble crops in the Dark Brown than in the Brown soil zone. With average prices, expected net incomes were highest for the three-year rotation but varied only slightly among rotations when the best crop combination for each was used. With low grain prices, high fertilizer prices, or high labor prices, the two-year rotation had the highest expected income. These results reflect the differences in input mix among rotations. Continuous cropping was best with high grain prices, low fertilizer prices, or low labor prices. Expected net income for the best crop combination in the three-year rotation was about 5 percent lower, 1 percent higher, and 6 percent higher than for the two-year rotation with low, average, and high grain prices, respectively. Expected net income with continuous cropping was about 28 percent lower, equal, and 15 percent higher in the same situations.

The effects on expected net incomes of changes in input and product prices in the Dark Brown soil zone were similar to those in the Brown soil zone but greater in magnitude. With low grain prices, expected net incomes were \$37.70, \$39.32, and \$42.54 a hectare lower than with the average prices for the two-year, three-year, and continuous crop rotations, respectively. With low fertilizer prices, expected net incomes were \$2.22, \$3.85, and \$6.89 a hectare higher. With low labor prices, expected net incomes were \$14.45, \$17.02, and \$22.03 a hectare higher. In the high price situations the effects were similar in magnitude to the low price situations but reversed.

In the Black soil zone (Table 5) continuous spring wheat produced the highest expected net incomes except under the low grain situation when barley was higher. In rotations that included fallow, crop combinations with rape on fallow and spring cereals on stubble had the highest expected net incomes.

Expected net income was highest for continuous cropping and lowest for the two-year rotation in all grain price situations in the Black soil zone. Expected net incomes for the best three-year rotation was about 28, 18, and 18 percent higher than for the best two-year crop combination with low, average, and high grain prices, respectively. Expected net incomes with continuous cropping were about 38, 39, and 46 percent higher in the same situations.

The effects of price changes on expected net incomes in the Black soil zone were again similar in nature to those in the other soil zones but again greater in magnitude. Expected net incomes with low grain prices were \$42.36, \$47.85, and \$59.20 a hectare lower for

TABLE 4. EXPECTED NET INCOME BY CROP COMBINATION AND ROTATION IN THE DARK BROWN SOIL ZONE

		Grain Price		Fertilizer Price		Labor Price	
Crop Combination[a]	Average[b] Prices	Low	High	Low	High	Low	High
				$/ha of rotation			
				Crop-Fallow-Rotation			
Winter Wheat	55.06	17.36[c]	92.06	57.28	53.06[c]	69.51	40.61[c]
Rape and Winter Wheat	50.59	13.98	86.40	52.54	48.88	64.99	36.19
Rape and Spring Wheat	44.71	8.72	79.68	46.41	43.25	59.53	29.89
Rape and Barley	43.05	10.77	74.49	44.76	41.67	58.27	27.84
Spring Wheat	43.35	6.87	78.67	45.08	41.87	58.59	28.11
Barley	39.89	10.89	68.07	41.50	38.61	55.97	23.81
				Crop-Crop-Fallow Rotation			
Winter Wheat (Spring Wheat)	55.67	13.36	97.24	59.43	52.39	72.30	39.05
Winter Wheat (Barley)	55.75[c]	16.43	94.45	59.60	52.44	72.77	38.73
Rape (Spring Wheat)	49.87	8.92	89.73	53.13	46.83	66.34	33.39
Rape (Barley)	49.75	11.98	86.97	53.30	46.90	66.84	32.65
Spring Wheat (Spring Wheat)	47.84	6.37	88.28	51.23	44.88	65.01	30.68
Spring Wheat (Barley)	47.89	9.41	85.51	51.40	44.93	65.48	30.31
Barley (Spring Wheat)	45.62	9.06	81.34	48.98	42.73	63.31	27.94
Barley (Barley)	45.65	12.10	78.57	49.15	42.78	63.75	27.52
				Continuous Crop Rotation			
(Spring Wheat)	55.01	3.46	105.72[c]	61.82	49.05	76.10	33.91
(Barley)	54.69	12.47	96.92	61.90[c]	48.95	77.04[c]	32.33

[a]Crop in brackets was produced on stubble.
[b]Refers to the input and product price combination in the first row of Table 1. Similarly, other columns of this table refer to the price situation in the corresponding row of Table 1.
[c]Refers to the cropping program with the highest expected net income for that price situation.

TABLE 5. EXPECTED NET INCOME BY CROP COMBINATION AND ROTATION IN THE BLACK SOIL ZONE

		Grain Price		Fertilizer Price		Labor Price	
Crop Combination[a]	Average[b] Prices	Low	High	Low	High	Low	High
				$/ha of rotation			
				Crop-Fallow Rotation			
Rape	59.40	17.04	100.87	61.28	57.67	79.14	39.67
Spring Wheat	49.40	7.80	89.76	51.40	47.72	70.30	28.50
Barley	42.51	8.92	74.74	44.48	40.75	65.45	19.56
				Crop-Crop-Fallow Rotation			
Rape (Rape)	65.50	17.44	112.34	69.23	62.05	86.60	44.41
Rape (Spring Wheat)	69.73	19.96	118.86	73.73	66.17	91.59	47.87
Rape (Barley)	67.50	21.88	112.83	71.65	63.82	90.06	44.95
Spring Wheat (Rape)	62.89	13.61	111.27	66.94	59.30	85.51	40.26
Spring Wheat (Spring Wheat)	58.66	11.09	105.00	62.49	55.20	80.55	36.78
Spring Wheat (Barley)	60.66	15.46	104.95	64.86	56.98	83.95	37.37
Barley (Rape)	56.36	16.75	95.14	60.49	52.76	80.87	31.86
Barley (Spring Wheat)	55.11	12.89	96.01	58.91	51.52	77.83	32.36
Barley (Barley)	59.35	15.39	102.26	63.38	55.65	82.79	35.91
				Continuous Crop Rotation			
(Rape)	71.60	12.08	129.77	79.04	64.47	94.33	48.88
(Spring Wheat)	82.79[c]	18.06	147.09[c]	90.97[c]	75.38[c]	107.77[c]	57.82[c]
(Barley)	75.85	23.59[c]	127.97	84.50	68.25	103.00	48.71

[a] Crop in brackets was produced on stubble.
[b] Refers to the input and product price combination in the first row of Table 1. Similarly, other columns of this table refer to the price situation in the corresponding row of Table 1.
[c] Refers to the cropping program with the highest expected net income for that price situation.

the two-year, three-year, and continuous crop rotations, respectively, than with average prices. With low fertilizer prices, expected net incomes were \$1.88, \$4.00, and \$8.18 a hectare higher, and with low labor prices they were \$19.74, \$21.86, and \$24.98 a hectare higher.

RESOURCE REQUIREMENTS

The estimates of resource requirements reported here pertain to the *average price* situations used in the preceeding analysis of expected net incomes (first row of Table 1). Fertilizer costs were estimated from the optimal rates with average prices for fertilizer and grains. Labor rates were \$5.00 an hour.

The average costs over the five-year period for resource services (fuel and oil, machinery and building repair, seed, fertilizer, herbicides, grain storage, crop insurance, and labor) were lowest for the two-year rotations and highest for continuous cropping in all soil zones (Table 6). Average costs were lowest in the Brown soil zone and highest in the Black soil zone. Average costs among crop combinations within a rotation and soil zone were similar (not shown).

TABLE 6. AVERAGE COSTS BY ROTATION IN THE BROWN, DARK BROWN AND BLACK SOIL ZONES

Rotation	Brown	Dark Brown	Black
		\$/ha of rotation	
Crop-Fallow	44.43	54.88	66.49
Crop-Crop-Fallow	56.51	69.65	82.40
Continuous Crop	81.41	100.90	113.69

The resource categories most affected by rotation were machine operating costs (fuel, oil, and repairs), labor, and fertilizer and chemical costs (Figure 1). Costs incurred for seed, building repair, crop insurance, etc., increased directly with the area cropped (not shown). Rotation had the greatest influence on fertilizer and chemical costs. In the Brown, Dark Brown, and Black soil zones, fertilizer and chemical costs for the three-year rotation were 83, 92, and 106 percent higher, respectively, than for the two-year rotation. For continuous cropping, fertilizer and chemical costs were 249, 277, and 318 percent higher than for the two-year rotation. The costs incurred for chemicals, machinery operation, and labor also increased in the rotations with less fallow but to a smaller degree. The relative differences in machine operating costs and labor between the high and low fallow rotations decreased from the Brown to the Dark Brown to the Black soil zones. This was due to the larger number of tillage operations on fallow in the higher rainfall zones.

The seasonality of labor requirements differs with rotation and crop combination (Figure 2). Labor requirements for the two-year rotations were relatively uniform during the growing season. However, for the three-year and continuous crop rotations, labor requirements were concentrated in the spring and fall. The crop combination with winter wheat used less spring labor but more summer labor than those with only spring crops. This is directly related to the management practices used for winter wheat production, i.e., seeding in the fall and harvesting in the summer.

SUMMARY

Expected net income is one important criterion in cropping program selection. The results of the study show that expected net incomes vary greatly among crop combinations and rotations within a soil zone as relative input and product prices change. High grain prices and low input prices generally favored the cropping programs with less fallow. Low grain prices and high input prices favored the rotations with a high proportion of fallow. In the Brown soil zone the two-year rotation produced the highest expected net incomes for all input and product price combinations examined. In the Dark Brown soil zone the three-year rotation produced the highest expected net income with average prices, but the ranking of rotations and crop combinations was very sensitive to the price situation. In the Black soil zone, continuous cropping produced the highest expected net income in all price situations examined.

Costs differ markedly in amount and seasonal distribution among rotations. The differences in seasonal labor demands among rotations are especially important considerations in crop and rotation selection. A rotation with a fairly uniform seasonal distribution of labor requirements might be chosen over one with high labor demands in some season despite lower expected net incomes. This factor could explain the continued high proportion of fallow in areas where expected net incomes appear to favor rotations with less fallow.

The results are not necessarily applicable to all farming situations in the Prairie Provinces. Differences among farms in resource supplies (land base, machinery inventory, and seasonal labor supply), financial circumstances, economic expectations (e.g., price expectations and quota restrictions), and preferences could cause the ranking of cropping programs to differ among farms. A sensitivity test with different farm sizes and

SPECIFIC COSTS OF ITEMS BY ROTATION:
CROP-FALLOW (CF), CROP-CROP-FALLOW (CCF), AND CONTINUOUS CROP (CC); AND SOIL ZONE

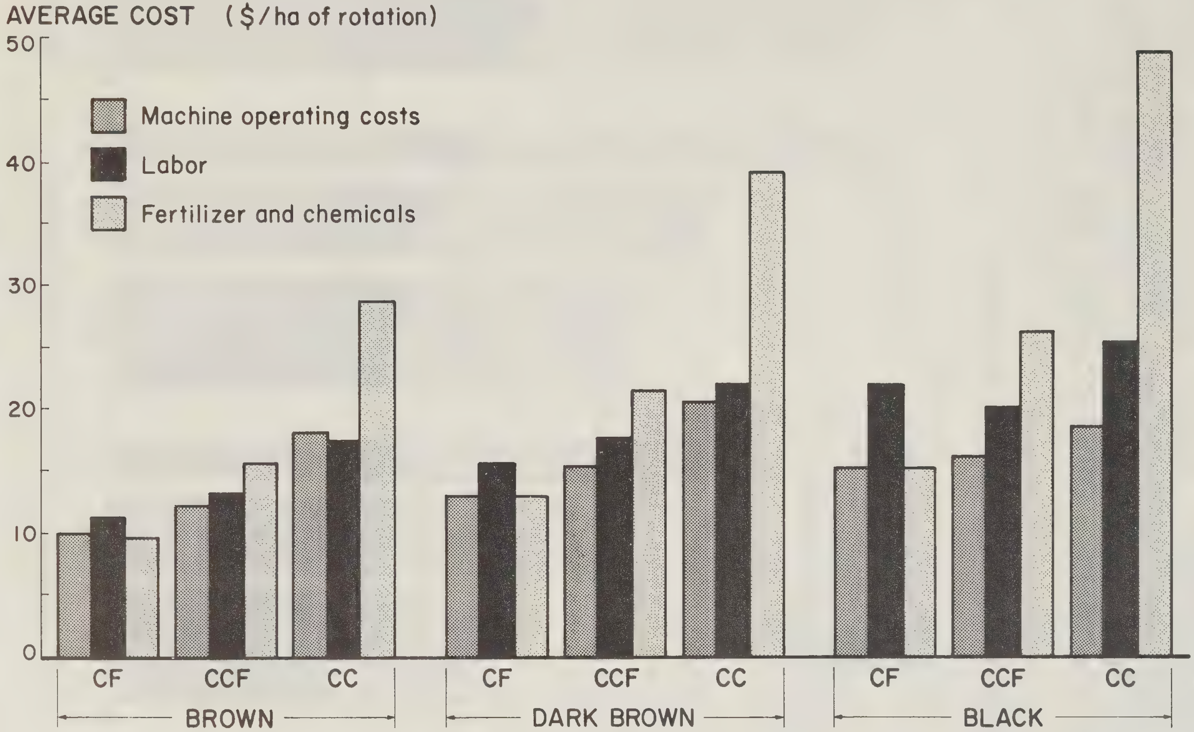

Figure 1

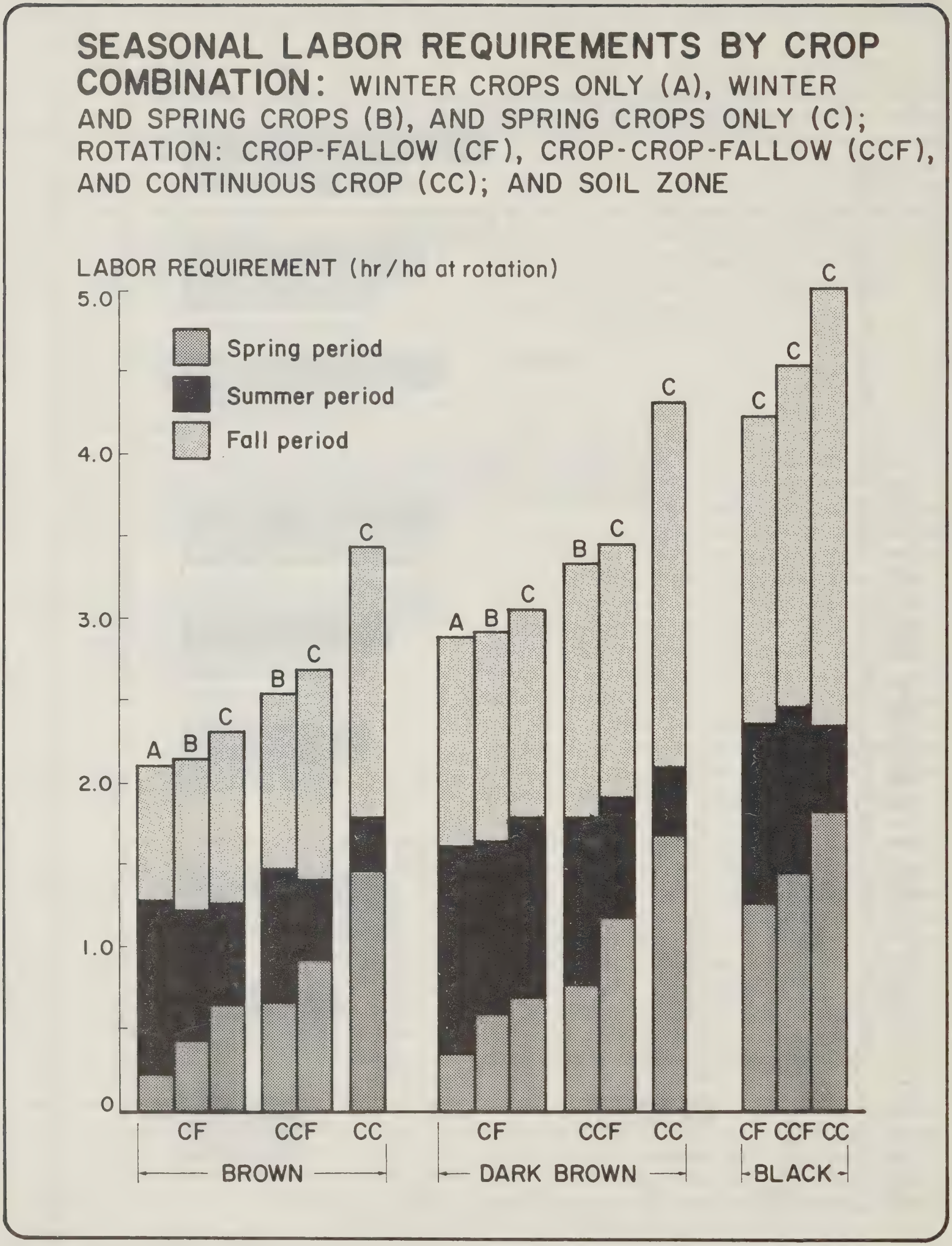
SEASONAL LABOR REQUIREMENTS BY CROP COMBINATION: WINTER CROPS ONLY (A), WINTER AND SPRING CROPS (B), AND SPRING CROPS ONLY (C); ROTATION: CROP-FALLOW (CF), CROP-CROP-FALLOW (CCF), AND CONTINUOUS CROP (CC); AND SOIL ZONE
LABOR REQUIREMENT (hr / ha at rotation)
5.0
4.0
3.0
2.0
1.0
0
Spring period
Summer period
Fall period
A B C B C C A B C B C C C C C
CF CCF CC CF CCF CC CF CCF CC
BROWN
DARK BROWN
BLACK

Figure 2

newer and older machinery complements revealed no large differences in expected net incomes and resource requirements among cropping programs. The simulation model used in the analysis can accommodate farms with widely differing economic and physical characteristics.

Expected net income and seasonality of labor requirements are important criteria in selecting an optimal cropping program. Differences in income variability among cropping programs is another important factor in cropping program decisions. This will be the subject of a future article.

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THE ECONOMICS OF WARBLE FLY CONTROL

Warble fly control can increase the demand for beef and hides, increase the supply of beef, and decrease the marketing margin for beef products. Cattle producers and consumers of beef have the most to gain from warble control. Economic incentives appear to be more effective than coercion in raising the level of grub control. Cheap and effective systemic insecticides lower the economic threshold of warble control and thus encourage farmers to treat their cattle. In addition, cattle-buying practices discriminate against warble-infested animals.

*Kurt K. Klein**

INTRODUCTION

Warble flies (*Hypoderma lineatum* and *Hypoderma bovis*) have long been considered a serious livestock pest. Khan (1968) estimated that warbles were responsible for a loss of more than $400,000 for the cattle slaughtered in Alberta between January 18 and May 20, 1968. In 1976 Alberta Agriculture (1976) estimated the damage to carcasses that went through Alberta packing plants from late February to late May at $1.5 to $2 million, and in 1977 Alberta Agriculture (1977) estimated losses from reduced live weight gains and damaged carcasses and hides in Alberta at $4.3 million; extrapolating this loss to all of Canada means that warbles cost the Canadian beef industry $14.3 million.

The Meat Packers' Council of Canada (1968) estimated warble losses per carcass (including the hide) at $10 for carcasses having more than 10 grubs. In 1972 the Ontario Ministry of Agriculture and Food (1972) estimated a combined carcass and hide loss of $18.81 for animals having more than 10 grubs. More recently, the carcass and hide losses on heavily infested animals were estimated at $25-$30 an animal, and when combined with the weight losses incurred by the warble-infested animals, produced a loss of $58 for every infested animal slaughtered (Alberta Agriculture 1977).

These large loss estimates have sparked a debate about the desirability of compulsory warble control programs. Alberta (Khan 1976) and Saskatchewan recently instituted programs with the explicit objective of eradicating warbles from the control area. Although other provinces have so far been reluctant to enjoin their producers in similar mandatory control schemes, their interest in continuing a "war on warbles" seems unabated (Ontario Ministry of Agriculture and Food 1972; Smith, D. L., Senior Entomologist, Manitoba Department of Agriculture, Winnipeg, personal communication 1977).

This paper examines the evidence on economic costs and benefits of warble control. The major beneficiaries of warble control are identified and an attempt is made to determine the amount of benefits that can be expected from a successful warble control program. The economic threshold of warble control is discussed in terms of private operators' incentives to treat their cattle for warbles. The paper concludes with an examination of research areas that have potential for a high

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*Dr. Klein is a research economist at the Agriculture Canada Research Station, Lethbridge, Alberta. This paper was adapted from a report prepared for the Western Committee on Livestock Pests in 1977. The author extends his appreciation to the many members of this committee who commented on the report and made available many unpublished materials, in particular, M. A. Khan and J. Weintraub of the Agriculture Canada Research Station, Lethbridge, Alberta, who contributed much material, time, and encouragement. The author also thanks Ross Gould, Alberta Agriculture, for making available many unpublished reports and surveys. Any errors remain the author's responsibility.

payoff through either reducing the real costs of warble control, or increasing the knowledge of beef producers and administrators of regional warble control programs for the purpose of selecting the optimal level of pest control.

BENEFITS OF WARBLE FLY CONTROL

The benefits from a warble control program can arise from increased consumer demand for beef and hides, and an increased supply of beef and hides due to lower production costs and elimination of grub damage to beef.

The marketing margin (i.e., the difference between wholesale and farm level prices of beef cattle) might also be reduced if fewer cattle are infested with warbles. This decreased marketing margin would be due to lower labor costs for trimming and the easier task of finding markets for the trimed carcasses. It may seem that anything reducing meat packers' costs would increase their profits. However, if the packing industry is reasonably competitive, it will bid away most of its cost savings, thus providing higher prices to producers or lower prices to consumers. (The question of what degree of competitiveness exists within the packing industry is too large for this study; however, it does show evidence of a competitive industry with consistently low rates of return on total assets – from 2.8 to 6.6 percent between 1965 and 1971 according to Statistics Canada [1965–71]).

Demand

The demand for beef is mainly a function of its price relative to the prices of other red meats. If consumers preferred beef that had not suffered extensive grub damage, they might demand more beef at each price level if warbles were controlled.

A "devaluation loss" has often been applied to entire carcasses of warble-infested animals. This covers the reduction in sales value due to the marred appearance of infested carcasses. The Meat Packers' Council of Canada (1968) estimated the devaluation loss per carcass to range from $0.60 to $7.50, depending upon the extent of the damage. However, the amount of devaluation loss is probably dependent upon local, short-run (warble season) conditions of demand and supply for the various qualities of beef. If a small number of infested animals were received, the price differential could be very small. Conversely, a large run of badly infested animals might present severe marketing problems for packers and result in marked price discounts for infested carcasses.

The demand for hides is derived from the demand for finished leather goods. Leather prices have been erratic in recent years, causing wide fluctuations in hide prices. Between 1963 and 1975, prices for hides fluctuated from a low of $6.56 a hide in 1964 to a high of $18.12 in 1973 (Statistics Canada 1963–75). Hide prices lately have increased sharply, more than $20 a hide in early 1978 and almost $40 late in the year.

Hides are degraded from No. 1 to No. 2 if they have five or more warble holes (Pinches, G., Hide Trading Manager, Canada Packers, Lethbridge, personal communication 1977). The price discount may vary, depending upon market conditions. However, for the wide range of leather prices experienced in 1977 and 1978, the price discount remained about $0.022 per kg in Western Canada, or about $0.65 to $0.75 on a steer hide and $0.55 to $0.65 on a cow hide. This is similar to the $0.75 hide loss estimated by the Meat Packers' Council of Canada (1968), although they applied this loss to all hides with one or more warble holes.

Packing house and auction market surveys reveal that the rate of warble infestation has dramatically declined since 1968 (Alberta Agriculture 1973; Gould, R., Livestock Supervisor, Alberta Agriculture, Edmonton, personal communication 1977). In Alberta, where a provincially sponsored warble control program (Government of Alberta 1975; Khan 1976) has been in effect since 1968, the rate of warble infestation in carcasses monitored at packing plants has dropped from 44 percent in 1968 to 25 percent in 1973, to 15 percent in 1977, and to 10 percent in 1978 (Alberta Agriculture 1969, 1973; Gould, R., personal communication 1977, 1978). The damage per hide for all animals slaughtered has declined from $0.11 in 1968 to less than $0.04 in 1978.

Other types of damage to hides are much more significant than warble holes. Butcher damage occurs to about 25 percent of all hides, resulting in an average loss per cured hide of about $0.20. Branded hides are discounted by $2.25 to $5.00 per cured hide (Pinches, G., personal communication 1977).

Beef producers would receive most of the benefits from an increased demand for warble-free beef and hides since either the same quantity of beef would fetch higher prices, or an increased quantity of beef would be purchased at the same or slightly higher prices.

Supply

Beef supply is primarily a function of the expected beef prices and the prices of the various production in-

puts. It is possible that with a successful warble control program, more beef would be produced at each price level because of more efficient feed conversion and elimination of trim on carcasses.

Unfortunately, many of the warble-related studies have focused primarily on the efficacy of various insecticides and secondarily on differences in weight gains among warble-infested and noninfested cattle. Direct production cost comparisons have not been made. Experiments conducted in North America on differences in weight gains between treated and untreated cattle (Steelman 1976) have been less than conclusive. Many have reported increased weight gains of up to 0.15 kg per day for the warble-free cattle, though in several cases the differences were statistically insignificant. A few studies have reported lower weight gains for warble-free animals.

The picture is clouded even more by the possibility of compensatory gains by the untreated animals in the post-infestation period. If the reduced weight gains of warble-infested animals were completely recovered (and the feed intakes were identical), then there would be no change in the production costs of those animals not destined for market during the warble season. Of course the animals to be slaughtered before the onset of compensatory gains may still have increased production costs if they were infested with warbles.

Weintraub and Thompson (1959) noted some evidence of compensatory gains in warble-infested animals past mid-February, thereby prompting them to conclude that "the longer the delay in slaughter (from peak warble activity), the less final advantage there is in treating."

The lack of comparative research data on feed intakes by treated and untreated cattle makes it impossible to analyze production cost differences. An additional obstacle is the scarcity of conclusive data on compensatory gains in the post-infestation period.

Grub-infested animals do have a slight effect on beef supply because of the extra trimming required on their carcasses. The Meat Packers' Council of Canada (1968) has estimated that up to 1.14 kg of extra trim must be made on heavily infested carcasses.

The major beneficiaries of an increased beef supply would normally be consumers since they would receive increased quantities of product at slightly lower prices. This would not be true, however, where the supply effect was localized, i.e., in one province or region. A small increase in supply from one region would have little or no effect on product prices. In this case producers would again recover most of the benefits from an increased supply.

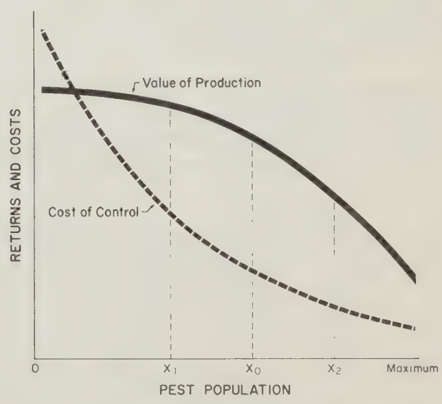
OPTIMAL CONTROL LEVEL

It was assumed for the study upon which this paper is based that farmers attempt to maximize their *expected* net income. In so doing, they will adjust the use of their discretionary resources (i.e., resources that may be used or not used on individual farms) in response to market signals. They will, theoretically, employ inputs to a level where the cost of the extra unit of their use just equals the increase in production value from that unit of input.

Pesticides can be regarded as discretionary inputs into cattle production. More pesticides will be used if the cost of their use is decreased, or if the extra value of production made possible by their use is increased.

Headley (1972) defined the economic threshold of pest control as the point where the incremental value of the production loss due to pests was just equal to the incremental cost of reducing the pest problem. In Figure 1 the production value stays relatively constant at low levels of pest infestation, then decreases at an increasing rate as the pest population level becomes larger. There is no cost for no control. The costs become increasingly higher as the pest population is reduced. Eradication of the pests is very costly.

FINDING THE ECONOMIC THRESHOLD OF PEST CONTROL



Source: Headley (1972)

Figure 1

At pest population X_0 the rate of change in the value of production function equals the rate of change of the control cost function, that is, the profit maximizing control level. If pests were controlled at levels X_1 or X_2, for example, farmers would receive less profit.

This model has some interesting implications. First, the economic threshold is determined by product prices and control costs. If the product's price increases or the control cost decreases, or both, the optimal level of pest control increases. Second, the pest population level justifying control measures is usually larger than the population level where first damage occurs. Third, it indicates that the only time it would be rational to eradicate pests would be if the costs of maintaining zero-level populations were less than the costs of maintaining populations at levels greater than zero.

This model assumes that farmers have full knowledge of the relationship between pesticide application and pest damage as well as pesticide costs and future cattle prices. If farmers do not and are risk averse (that is, they require additional net revenue to assume greater risk), it can be shown that they will use fewer variable inputs than what is optimal in a full knowledge situation. With regard to Figure 1, risk averse farmers who are uncertain about the true consequences of pests would undertreat, perhaps allowing for pest population level X_2.

It should be emphasized that in the case of chemical warble control, a large proportion of the total labor and cost requirement may often be incurred in 'rounding-up' and sorting the cattle. Warble treatments cannot be combined with dehorning, weaning, or castration because of restrictions specified on labels of systemic insecticides. Thus an increase in cattle prices or a decrease in treatment costs would induce some farmers who previously had not treated any of their animals to treat some or all of their herd. Conversely, a decrease in cattle prices or an increase in treating costs might make it unprofitable for a farmer who had previously treated his entire herd to continue treating. He would be expected to discontinue or reduce his warble-control practices.

The results of auction market inspections in Alberta lend credence to the economic threshold model. After a continuous decline throughout the early 1970s in the proportion of infested marketed cattle, a startling increase in warble-infested cattle was noted in 1976, a year of severely depressed cattle prices. The 1977 results (cattle prices had improved somewhat) were only slightly better. However, the 1978 market inspections revealed a substantial decline in the proportion of warble-infested cattle (Gould, R., personal communication 1978). This coincided with a dramatic upturn in current and expected cattle prices.

It is also instructive to look at Alberta's Newell County, the only county that had not joined the Alberta warble control area by 1977. Only about 1 percent of the cattle marketed at the Brooks cattle market in the county carried grubs during the 1976 and 1977 warble seasons (Gould, R., personal communication 1977), compared with the provincial average of about 5 percent for those years (Alberta Agriculture 1976). The Newell County farmers, who were not subject to the terms of the compulsory warble control legislation and were therefore acting only in their own best interests, were obviously using effective warble-control measures.

Table 1 shows the extra gain per slaughter animal that a farmer would require to pay the costs of warble treatment under three categories of labor requirement (to simulate good, medium, and poor handling facilities), for 0, 25, 50, and 75 percent compensatory gain, and for three reservation prices for labor. Reservation prices of labor can be regarded as either the price a farmer would have to pay to hire competent labor or the price the farmer himself requires to induce him to substitute this labor from other tasks or leisure activities. Only one chemical cost was used: $0.003 per ml.

The extra gain required to pay for control rises rapidly for situations involving higher labor requirements and prices. Similarly, much more gain is required to cover the treatment costs if compensatory gains are significant. On the other hand, the differences in gain for the cases of low labor costs and high cattle prices, even with some compensatory gains, are smaller in many cases than would be required to demonstrate statistically significant differences in most experiments.

The economic threshold of warble control is very sensitive to price discounts on warble-infested slaughter cattle. A discount of only $0.25 a cwt on all slaughter cattle makes it profitable to treat all cattle in most instances even if no differences in gain are expected.

Less weight gain is required to pay for the warble treatment if the price of slaughter cattle rises from $50 to $60 a cwt. A rise in the price of finished cattle would therefore result in more farmers treating their herds and a lower overall infestation rate.

The major implication of Table 1 is that most farmers would find sufficient economic incentive to continue treating for warbles even in the absence of government-

TABLE 1. EXTRA GAINS REQUIRED BY FEEDLOT ANIMALS TO PAY FOR WARBLE CONTROL, WITH AND WITHOUT COMPENSATORY GAINS, ALL ANIMALS TREATED

Average Price Finished Animals ($/cwt)	Category of Labor Requirement[a] (hr/hd)	Price of Labor[b] ($/hr)	Extra Beef Required For Break-Even[c] (kg/hd)			
			0% Comp. Gain	25% Comp. Gain	50% Comp. Gain	75% Comp. Gain
50	0.05	0	1.3	1.7	2.5	5.0
50	0.05	3	1.8	2.4	3.6	7.2
50	0.05	6	2.3	3.1	4.7	9.4
50	0.10	0	1.3	1.7	2.5	5.0
50	0.10	3	2.3	3.1	4.7	9.4
50	0.10	6	3.4	4.5	6.8	13.7
50	0.15	0	1.3	1.7	2.5	5.0
50	0.15	3	2.9	3.8	5.8	11.5
50	0.15	6	4.5	6.0	9.1	18.2
49.75	0.10	0	−1.2	0.0	0.0	0.0
49.75	0.10	3	−0.6	0.0	0.0	0.0
49.75	0.10	6	1.0	1.3	2.0	4.0
60	0.10	0	1.0	1.4	2.1	4.1
60	0.10	3	1.9	2.6	3.9	7.7
60	0.10	6	2.9	3.8	5.8	11.5

[a] Labor inputs are categorized into good (0.05 hr/hd), medium (0.10 hr/hd), and poor (0.15 hr/hd) handling facilities.
[b] Labor price means either the cost of hiring one hour of labor or the value of operator labor for other occupational or leisure activities.
[c] Assumptions:

1. Animals treated include cow unit (450 kg), 85% of weaned calf unit (225 kg), 4% of bull unit (900 kg), 15% of replacement heifer unit (360 kg), and 70% of feeder unit (360 kg).
2. Cost of capital is 10% a year.
3. There is an 85% calf crop and a 2.5% death loss in the herd and in the feedlot.
4. Cull cow prices are half those of finished cattle.
5. The total feed consumed is the same for treated and untreated cattle.

sponsored economic incentives or coercion. In most herds, only 1-3 kg of non-compensated extra gain per saleable animal is sufficient to pay for the treatment costs. Farmers who have poor handling facilities or are faced with high opportunity or reservation prices for their labor, or both, will find less economic incentive to treat and might not treat at all.

CONCLUSIONS

Losses due to warbles, while significant, do not appear to be as extensive as some have claimed. No evidence has been found of the extent of gadding losses. While isolated cases of gadding undoubtedly still occur, it is unlikely that it causes significant losses in cattle production today. There appear to be *economically* significant reductions in weight gains during the warble season, but the extent to which they may be compensated in the post-infestation period is unclear. There are definite losses associated with carcass trim and carcass and hide degradation. However, the amount of the devaluation and degrading loss is market-determined; it therefore fluctuates in response to changes in supply and demand in the beef and hide markets. Cattle buyers (at least in Alberta) have been much better informed in recent years on expected levels of warble infestation in the cattle they are buying. All cattle sold through public auction markets in Alberta during the warble season are inspected and identified as warble-free or infested. In private purchases, packer buyers carefully inspect cattle offered for sale and usually consider the reputation of cattle feeders who have previously sold them cattle. If warble-infested cattle escape their notice in one sale, they usually become very cautious at the next, perhaps refusing to bid at all.

It is therefore unnecessary and economically impractical to eradicate warbles chemically. The market system establishes price discounts for warble-infested carcasses and hides. If farmers are informed of the relatively cheap and effective systemic insecticides as well as the losses caused by warbles, most would find sufficient

economic incentives to control warbles on their own farms. Extra-market coercion does not appear to be necessary to achieve an optimal level of warble control.

Consumers and cattle producers have the most to gain from warble control, since a competitive packing industry bids away most reductions in marketing margins. Consumers gain from the somewhat larger quantity of beef marketed when warbles are controlled, and the slight reduction in beef prices which may result. Producers gain directly from any increase in consumer demand for warble-free beef. They also share with consumers the benefits from decreased average production costs. Packers benefit primarily from better relations with producers and consumers, which may permit more rapid industry growth.

Future Research

The efficiencies gained in beef production through better warble control represent a return to research and extension activities. This return can be increased if cheaper (in real terms) or more effective control measures can be developed. In addition to sponsoring continued research into the conventional warble control methods, research funding could be usefully applied in the following areas.

Integrated Control Methods

Integrated pest management is a combination of strategies designed to decrease losses due to pests. It combines insecticide use with biological regulatory factors. Selective chemical treatment of cattle based upon this concept has apparently been effective in achieving low levels of grub infestation in the U.S.S.R., where large areas are now warble-free and other areas have very low levels of warble infestation (Khan 1977).

Much more must be known about the natural rates of increase and decrease of the warble species before an integrated approach to their control can be employed. Farmers would require information on expected population levels before they could comfortably use such varied control strategies as treating every two or three years, or treating all young animals plus the breeding herd every two or three years.

Preliminary research has suggested the possibility of early detection of warble grubs (Robertson 1978). Skin tests and blood samples taken from cattle in an early infestation stage would permit much more selective treatment, if these tests could be made practical at a farm or district level.

Experiments in progress at the Agriculture Canada Research Station, Lethbridge, Alberta, on the sterile male technique for control may provide the means for a successful integrated approach to warble control (Weintraub 1978). The release of sterile males under conditions of low grub populations can virtually eradicate warbles in the release area.

Alternative Chemical Applicators

Farmers who must use a large amount of labor to treat their herds or who have a high labor reservation price, or both, will often find it unprofitable to treat their animals. Some alternative treatment methods that entail a much lower labor component may make it economically feasible to treat their herds, even if the alternative applicators do not apply as precise a dosage to the animals. Back-rubs, feed additives, and perhaps even long-term innoculations are possibilities that should be investigated. Over-concentration on attempts to eradicate grubs, which implies complete treatment of all animals at correct dosages, may be less effective in reducing the warble populations on some of these farms than a less complete program that is easier and less costly for the farmers to administer.

Economic Threshold of Grub Control

Farmers require three types of unavailable data to make profit maximizing decisions concerning grub control. They are as follows:

1. the effect of grub infestation on feed intake and feed efficiency;
2. the level of compensatory gains that can be expected from infested animals in the post-infestation period; and
3. the amount of variation in bid price discounts on warble-infested animals.

Researchers should consider additional investigations into these data deficiencies using carefully controlled experiments and price analyses of animals sold during the warble season.

Economic incentives appear to be more effective than coercion in enhancing the level of grub control. Extension programs may therefore be more effective if they concentrate on providing the types of information farmers need to make profit-maximizing decisions. The information falls into such categories as what chemicals to apply, dates and rates of application, weight losses from infestations of various levels, expected price

discounts on infested animals, and expected infestation levels in the coming year. Of course it never hurts to appeal to farmers' pride in maintaining high quality, warble-free beef herds.

Compulsory warble control programs that force a level of pesticide usage higher than would ordinarily be used with full information on the consequences and costs of warble control, and that contain mandatory price discounts for infested cattle, or both, would invariably lead to increased production costs for Canadian beef producers – a situation that should be avoided in the interests of remaining competitive with other suppliers.

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ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE

Item	Units or Base	1977				1978					1979
		II	III	IV	Annual	I	II	III	IV	Annual	I
Production and Income											
1. GNP at Market Prices[a]	$ mil.	207,228[b]	211,504[b]	216,824[b]	209,379[b]	221,428[b]	228,052[b]	233,600[b]	238,548[b]	230,407[b]	247,640
2. Farm Cash Receipts Total[d]	$ mil.	2,222.9	2,624.3	2,664.8	10,171.9	2,992.6[b]	2,705.6	2,954.7[c]	3,323.1[c]	11,887.4	3,396.0
3. – Total Crops[d]	$ mil.	754.5	1,107.5	1,140.0	4,429.0	1,470.7[b]	1,004.7[c]	1,148.6[c]	1,312.3[c]	4,934.4	1,443.6
4. – Total Livestock[d]	$ mil.	1,308.6	1,393.4	1,401.1	5,245.8	1,419.1[b]	1,608.6[c]	1,711.2[c]	1,894.3[c]	6,568.7	1,876.6
5. Net Income Rec'd by Farm Operators[a]	$ mil.	3,344.0[b]	2,828.0[b]	2,712.0[b]	2,874.0[b]	3,020.0[b]	4,152.0[b]	3,252.0[b]	3.632.0[b]	3,514.0[b]	3,708.0
Trade											
6. Agricultural Exports	$ mil.	1,115.0	1,120.0	1,088.9	4,264.9	946.4	1,230.5	1,261.4	1,390.1[c]	4,828.0[c]	1,204.4
7. Agricultural Imports	$ mil.	980.5	827.5	880.9	3,555.8	876.6	1,088.5	943.2	1,104.4[c]	4,012.7[c]	1,129.2
8. Real Domestic Product, Ag[a]	1971=100	100.6	104.2	104.8	101.3	109.9	107.4	109.8	108.9	109.2	110.4
9. Real Dom. Prod. Less Ag[a]	1971=100	129.4	130.2	131.1	130.0	132.0	133.4[b]	134.4[b]	136.7	134.2	137.7
Price Indexes											
10. Farm Input Price Index	1971=100	181.2	181.3	181.7	180.0[c]	190.8	200.2	203.2	209.2	200.9	221.0
11. – Buidlings and Fencing	1971=100	180.8	186.7	190.0	183.9	193.5	197.6	203.1	209.9	201.0	216.0
12. – Machinery & Motor Veh.	1971=100	163.7	165.0	169.1	166.4	172.6	174.0[b]	176.0[b]	182.1	176.1	188.0
13. – Crop Production	1971=100	214.9	215.2	216.1	213.7	217.9	225.5	228.3	230.2	225.5	235.6
14. – Animal Production	1971=100	173.2	169.3	165.2	167.4	178.0	203.7	207.3	218.2	201.8	247.0
15. – Hired Farm Labor	1971=100	207.0	211.0	213.0	208.6	214.5	217.9	223.9	225.4	220.4	228.0
16. – Interest	1971=100	244.8	244.8	244.8	244.8	284.5	284.5	284.5	284.5	284.5	284.5
17. Farm Prices of Ag. Prod.[d]	1971=100	195.3	189.9	187.1	189.6	192.7	206.8	209.9	221.9	206.9	234.3
Input and Credit											
18. Farm Impl. & Equip. Sales[e]	$ mil.	298.3	379.1	283.5	1,124.6	153.9	372.9	418.8	342.4	1,288.0	N.A.[f]
19. Employment in Agriculture[a]	'000	463.7	463.7	463.7	464.0	458.0	462.3	479.3	490.3	473.0	500.0
20. Av. Farm Labor Rates[d]	$/hr.	3.54	3.61	3.66	3.56	3.67	3.73	3.78	N.A.	N.A.	N.A.
21. Av. Hourly Earnings-Manuf.	$/hr.	6.34	6.44	6.57	6.38	6.67	6.77	6.87	7.03[c]	6.84	N.A.
22. F.C.C. – Gross Loan Disburs.	$ mil.	129.9	175.7	125.4	508.8	78.4	127.8	205.7	121.7	533.6	N.A.
23. F.I.L. – Loans Made	$ mil.	51.6	53.1	34.1	163.7	37.8[c]	N.A.	N.A.	N.A.	N.A.	N.A.
24. CPI – All Items	1971=100	159.1	162.6	166.1	160.8	169.2	173.3	177.7	180.5	175.2	184.6
25. – Food at Home	1971=100	175.9	182.7	188.6	178.8	194.8	208.3	218.7	216.4	209.6	228.5
26. – Food Away from Home	1971=100	185.5	188.3	190.0	187.0	192.6	194.9	202.2	207.3	199.3	213.1

continued

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE (Concluded)

Item	Units or Base	1977 II	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual	1979 I
27. Industry Selling Price Index – Food & Beverage	1971=100	187.3	187.9	189.2	185.9	194.9	203.9	209.5	213.5[c]	205.5[c]	224.2[c]
Other Indicators											
28. Unemployment Rate	%	8.0[b]	8.2	8.4	8.1	8.4	8.6	8.5	8.2	8.4	8.0
29. Exchange Rate	$U.S.	1.05	1.07	1.10	1.06	1.11	1.13	1.14	1.18	1.14	1.19
30. Av. Rate on New Demand Loans	%	9.1	8.6	8.7	8.9	8.7	9.7	10.0	12.32	10.18	12.31
31. Quarterly Pop. Est.	mil.	23.22[b]	23.28[b]	23.34[b]	23.26[b]	23.39[b]	23.44[b]	23.50	23.55	23.48	23.60

[a]Seasonally adjusted at annual rates.
[b]Revised.
[c]Preliminary.
[d]Excludes Newfoundland.
[e]Excluding repair parts.
[f]N.A. = Not available.

Sources: All items appear in the *Canadian Statistical Review,* Statistics Canada, Catalogue No. 11-003, except the following:
No. 6 & 7 - Agriculture Canada, Policy, Planning and Economis Branch, Marketing and Trade Division.
No. 17 - Statistics Canada, Catalogue No. 71-001 and No. 18 - Catalgoue No. 21-002.
No. 20 - Farm Credit Corporation.
No. 21 - Farm Improvement Loans Office.
No. 29 & 30 - *Bank of Canada Review.*

NOTES

MULTILATERAL TRADE NEGOTIATIONS

The following highlights the results of the recently completed Multilateral Trade Negotiations (MTN) as they affect Canadian agriculture. The note was adapted from a news release prepared by Agriculture Canada's English Press Unit. We plan to publish a detailed article on the MTN in our next issue.

Canadian agricultural exports valued at more than $1 billion will benefit from concessions obtained in the MTN.

U.S. concessions cover nearly $500 million worth of imports from Canada and affect 80 percent of the dutiable items exported from Canada to the United States. About $230 million worth of previously dutiable Canadian agricultural exports to the United States now will enter duty-free. Another $60 million will be subject to tariff reductions of 50 percent or more.

Several U.S. and Canadian tariffs on products which are traded both ways have been reduced and matched at a lower level.

The European Economic Community (EEC), Canada's largest market for agricultural products, will reduce tariffs on a limited but nevertheless significant range of agricultural products, affecting about $140 million worth of Canadian exports.

From Japan, Canada's largest single country market for agricultural products, Canada obtained tariff concessions covering more than $400 million of exports at 1978 levels.

In general, the tariff reductions will be phased in over a seven-year period beginning January 1, 1980, and ending January 1, 1987.

In the livestock and meat sectors, the U.S. concessions include the removal of tariff rate quotas for live cattle under 200 pounds and over 700 pounds. These U.S. tariffs will be reduced and matched with Canada's, at one cent a pound.

On "portion control" beef cuts, the United States is reducing its tariff from 10 to 4 percent. However, sales come under the U.S. Meat Import Law.

U.S. and Canadian tariffs on fresh chilled or frozen beef will be reduced from three to two cents a pound.

Canadian pork exporters will benefit from the removal of the U.S. tariffs on live hogs and fresh or frozen pork; Canadian tariffs will similarly be eliminated. Also, the United States has agreed to reduce and match tariffs on most pork products.

From Japan, Canada obtained, on an unbound basis, a tariff reduction on fresh and frozen pork from 10 to 5 percent. (A bound tariff provides greater security than an unbound tariff; the importer must pay compensation to exporters if it later wishes to increase the tariff.)

In the dairy sector, a new arrangement for the export of Canadian cheddar cheese has been worked out with the EEC. Under this arrangement, a special quota of 2 750 t (6.1 million pounds) for Canadian aged cheddar will be established with lower minimum import price requirements and a reduced, fixed levy.

Since the United Kingdom joined the EEC in 1973, Canadian exports of cheddar to that country have averaged less than 500 t a year, well below pre-accession levels.

As part of the new arrangement, the EEC has agreed to operate its export subsidy system in a way which will avoid undercutting Canadian cheese prices. Canada has agreed to maintain its global cheese import quota of 45 million pounds, subject to review in 1982.

The MTN will result in significantly improved access for Canadian grains, oilseeds, and their products, particularly to the United States and Japan.

The United States will drop its corn tariff from 25 cents to five cents a bushel; the Canadian corn tariff will be cut from eight cents to match the U.S. level.

U.S. tariffs on oats, rye, and certified seed corn will be eliminated and the tariff on barley for malting will be matched with the Canadian rate at five cents a bushel.

The Canadian bakery industry will benefit from the elimination of U.S. tariffs for biscuits and cakes, macaroni, and pasta products. Canadian rates will be reduced to 5 percent on biscuits and removed on dry macaroni.

The United States will eliminate the tariff on soybeans, mustard seed, and sunflower seed and will also reduce rates on flaxseed, rapeseed, corn oil, and rapeseed oils.

Canadian rates will be reduced on certain crude vegetable oils from 10 to 7.5 percent, and on certain refined vegetable oils from 17.5 to 15 percent.

Japan has agreed to bind duty-free entry for rapeseed, soybeans, mustard seed, and rapeseed oilcake, and to reduce and bind the tariff on rapeseed oil.

In the fruit and vegetable sector, several important concessions were negotiated. Of major interest is the U.S. agreement to remove the tariff quota on seed and table potatoes (75 cents a cwt over quota, and 37.5 cents within quota) and to match the new Canadian tariff at 35 cents a cwt. In addition, the U.S. tariff on prepared potato products will be cut from 17.5 percent to 10 percent and matched with the corresponding Canadian tariffs.

Removal of the tariffs for fresh and frozen blueberries in the United States, a major reduction from 20 to 4 percent in the EEC tariff for frozen wild blueberries and a reduction from 20 to 10 percent for frozen berries other than strawberries in Japan, have been negotiated.

The U.S. tariff on canned corn is being reduced significantly, and important reductions have also been negotiated on canned and frozen corn in the EEC, Japan, and several other countries.

Finally, in the tobacco sector, the EEC has agreed to consolidate three existing tariff items into one with an effective maximum specific duty of 30 European Units of Account (EUA) per 100 kg (21.9 cents a pound) compared with the existing maximum duty of 45 EUA per 100 kg (32.8 cents a pound). In addition, Canada and the United States agreed to reduce and match rates on stemmed tobacco at 20 cents a pound, and at $12^3/_4$ cents a pound for unstemmed tobacco.

FOOD, NUTRIENTS, POPULATION, AND THE ECONOMY – A MODEL

This note describes an econometric model developed by Frank T. Denton and Byron G. Spencer of McMaster University for Agriculture Canada. This brief description should give CFE readers an awareness of the potential of using such a model for projection purposes. For a full description of the model and projections based on it, see Food Demand and Nutritional Requirements in Canada: An Econometric-Demographic Model with Projections for the Period 1976 - 2001, *by Frank T. Denton and Byron G. Spencer (with the assistance of Christine H. Feaver), a forthcoming publication from Agriculture Canada.*

The national demand for food is determined partly by the size and tastes of the population, partly by cultural influences, and partly by income and price levels. Patterns of food demand determine levels of demand for farm products. They also influence levels of nutrient consumption which may be compared with those suggested for good health. Changes in the size and composition of the population may alter total nutrient requirements and have direct effects on food demand. They may have indirect effects too, for population changes affect the size of the national labor force, the levels of output and income in the economy, and hence the levels of consumer expenditure (including expenditure on food). Changes in income and expenditure are associated also with changes in national saving and investment. They thus influence the rate of capital formation, and this in turn has implications for the expansion rate of the economy, and consequently for future levels of income and expenditure. The demands for food, nutrients, and farm products, and the levels of total nutritional requirements, may therefore all be regarded as determined within the broad context of population change and economic growth.

With the foregoing in mind, the authors developed a large economic-demographic model for Canada which incorporates a detailed representation of the food-nutrient and farm-product system. The model has been designed for use in computer simulation experiments and long-term projections. For example, it may be used to explore the implications of future population changes under different assumptions about birth rates, death rates, or rates of immigration and emigration. The implications of future productivity growth or of other changes in the Canadian economy may be explored. Changes in the relative prices of different types of food may be considered, and their implications for the allocation of total food expenditure among food products, and hence for the consumption of nutrients and the demand for products at the farm level. The model is a general-purpose tool that can be used in various ways to study and make projections for the food-nutrient and farm-product system in the context of the overall Canadian population and economy.

The authors believe this model is the first of its kind for Canada. There is scope for extending and refining it, as the present version is not viewed as final. However, the authors think that it does constitute a useful research tool and that it may be of general interest to persons concerned with prospects and policies relating to Canadian food and agriculture.

The model is outlined schematically in Figure 1. The model itself is quite large and the chart constitutes only

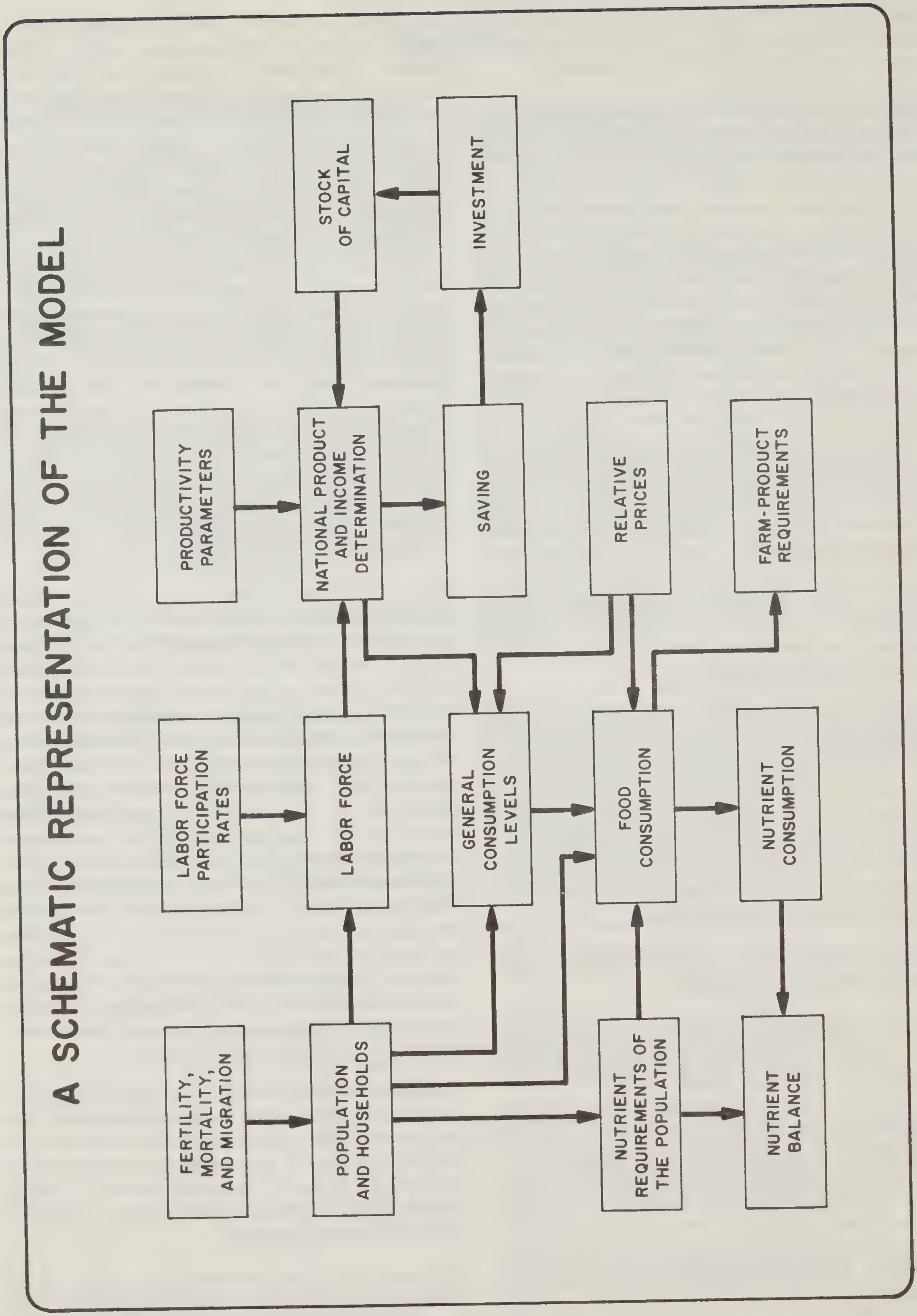
A SCHEMATIC REPRESENTATION OF THE MODEL
FERTILITY, MORTALITY, AND MIGRATION
LABOR FORCE PARTICIPATION RATES
PRODUCTIVITY PARAMETERS
POPULATION AND HOUSEHOLDS
LABOR FORCE
NATIONAL PRODUCT AND INCOME DETERMINATION
STOCK OF CAPITAL
GENERAL CONSUMPTION LEVELS
SAVING
INVESTMENT
NUTRIENT REQUIREMENTS OF THE POPULATION
FOOD CONSUMPTION
RELATIVE PRICES
NUTRIENT BALANCE
NUTRIENT CONSUMPTION
FARM-PRODUCT REQUIREMENTS

Figure 1

a summary depiction. Just the general contours of the model and the main channels of influence are represented. The latter are indicated by arrows.

The Canadian population and stock of households are determined by basic demographic factors, as indicated at the left side of the chart. Births are determined by fertility rates, deaths by mortality rates, and net migration is the difference between immigration and emigration. The number and average size of households are determined by the size and age composition of the population.

The population affects the general economy in two ways, first by its influence on the size and composition of the labor force, and second by its direct effect on consumption levels. The labor force changes in response to changes in the number of young people in the entrance-age range of the labor force and the number of older people entering the retirement range. It responds also to changes in participation rates, that is, to changes in the ratios of labor force to population of different ages and sexes. For given unemployment rates, the labor force determines the numbers of persons employed and the total input of labor services into production processes. The input of labor services, productivity levels, and the size of the national stock of capital determines national output. National income is determined jointly with national output.

National income is allocated between saving and consumption. The level of saving in each year determines the investment level, and this in turn determines the growth of the capital stock. As the chart indicates, there is a chain of effects from income to saving to investment to capital stock, and back to output and income. The connection between the rate of national saving and the rate of expansion of national production is thus established.

Consumption is influenced by population and household variables, income levels, and relative prices. The model first determines expenditures on broad categories of consumption, including private and public. (The latter represents current government expenditure in the national accounting terminology.) Private consumption is determined for each of several broad consumer categories, including the overall food category.

Total expenditure on food having been determined, the allocation of the food budget among individual types of food is then derived. Purchases of individual food types are influenced by the level of the overall food budget, the relative prices of different types of food, and the size of the population. They are influenced also by the nutrient requirements of the population, these requirements being a consequence not only of the size of the population, but of its age and sex composition as well.

Once the consumption levels of foods have been determined, the implicit consumption levels of nutrients are calculated. (In practice, the relevant concept is "domestic disappearance." Some of the food deemed to be consumed may be wasted and some of its nutrient content may be lost, either through food wastage or from processing and cooking.) The levels can be compared with the requirements based on prescribed nutritional standards, and the "nutrient balances" calculated, as indicated in the lower left corner of the chart.

Food consumption includes consumption of various farm products. (Fish is considered as well.) The farm-product requirements can be calculated, based on appropriate conversion factors, and this is done within the model. However, the model stops short of specifying product allocation between domestic farm sources and imports. It also does not deal with product exports and does not allow relative prices to be determined by the interaction of demand and supply forces, but rather requires that they be specified by a user of the model. This permits experimentation with different assumptions about price behavior. However, future extensions of the model to allow for the endogenous determination of farm supplies and food prices and for the explicit treatment of imports and exports of farm products, would appear essential and are under consideration.

The actual model consists of many equations and much detail. The population and related variables are treated by single years of age, and separately for males and females. Labor force and associated variables are treated separately by age-sex group. Different categories of private consumer expenditure, of government expenditure, and of investment expenditure are given separate treatment. In addition, food categories, nutrients, and farm products are dealt with in considerable detail.

This model has been estimated with a wide range of relevant Canadian data, employing econometric and demographic techniques. It has been designed to represent long-term relationships rather than short-term ones. Its intended use is thus in simulations or projections for periods ranging from five years to several decades.

PUBLICATIONS

The following six publications are available free from Alberta Agriculture, 9718 – 107 St., Edmonton, Alberta, T5K 2C8.

A Consensus of Costs and Returns – 200 Ewe Flock Sheep-Lamb Production in the Cardston District, Southern Alberta. A.G.N. Van Deurzen. March 1979. 9 p.

A Consensus of Costs and Returns – 125 Cow-Calf/Yearling Enterprise in the Willow Creek District, Southern Alberta. A.G.N. Van Deurzen. March 1979. 10 p.

A Consensus of Costs and Returns – Irrigated Carrot Production on a 320-Acre Farm in the Eastern Irrigation District, Southern Alberta. A.G.N. Van Deurzen. March 1979. 10 p.

A Consensus of Costs and Returns – Native Range Improvement in the Medicine Hat District, Southern Alberta. A.G.N. Van Deurzen. March 1979. 11 p.

A Consensus of Costs and Returns – Flax, Wheat, Barley, Rapeseed, and Summer Fallow on a 1000-Acre Farm in the M.D. of Willow Creek, Southern Alberta. A.G.N. Van Deurzen. March 1979. 13 p.

The Economics of Sugar Beet Production in Alberta – 1977. Lloyd Andruchow. 1978. 53 p.

The following five publications are available free from the Publications Manager, Policy, Planning and Economics Branch, Agriculture Canada, Room E-152B, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.

AERIS 1979 – Agricultural Economics Research Information System – Report 8. April 1979. 34 p.

A Beef-Forage-Grain Production Model for Farms in Western Canada. B.H. Sonntag and K.K. Klein. April 1979. 55 p. Publication No. 79/3.

Income of Farm Family Units, 1975. W. Darcovich, J. Gellner, and D. Leung. May 1979. 22 p.

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Beef Feeding and Management Guide. R.R. Corbett, P. Ag. April 1979. 57 p. *Available free from the Ministry of Agriculture, Province of British Columbia, Publications Office, Parliament Buildings, Victoria, British Columbia, V8W 2Z7.*

Farm Finance – Meeting the Challenge of Uncertainty. Proceedings of the Sixth Annual Agricultural Credit Conference, October 23-24, 1978. 286 p. *Available free from the Canadian Bankers' Association, P.O. Box 282, Toronto-Dominion Centre, Toronto, Ontario, M5K 1K2.*

Farm Machinery – Financial Management; Vol. 1 – Introduction to Machine Costs, Vol. 2 – Calculating Machine Costs, Vol. 3 – What Should I Charge for Custom Work? W.W. Stokes and B.A. Hackett. 1979. Approximately 6 pages each. *Available free from the Ministry of Agriculture, Province of British Columbia, Publications Office, Parliament Buildings, Victoria, British Columbia, V8W 2Z7.*

GATT Activities in 1978 (and Results of the Multilateral Trade Negotiations). 1979. *Available for U.S.$6 in English, French, and Spanish from booksellers or from the GATT secretariat, Centre William Rappard, 154 rue de Lausanne, 1211 Geneva 21.*

Grain Marketing in Canada. Charles F. Wilson. 406 p. *Available for $17.50 plus $1.50 for postage and handling from the Canadian International Grains Institute, 1000 – 303 Main Street, Winnipeg, Manitoba, R3C 3G7.*

Land Use and Agriculture. 1979. 15 p. *Available free from the Alberta Institute of Agrologists, No. 219, 12432 – 118 Avenue, Edmonton, Alberta, T5L 2K4.*

Off-Farm Work by Farmers. Ray D. Bollman. March 1979. 214 p. *Available for $2.80 from Publications Distribution, Statistics Canada, Ottawa, Ontario, K1A 0T6.*

Research Highlights – 1978. March 1979. 94 p. *Available free from the Research Station, Research Branch, Agriculture Canada, Lethbridge, Alberta.*

Response of the Federal Government to the Recommendations of the Consultative Task Force on the Canadian Food and Beverage Industry. May 1979. 30 p. *Available free from the Department of Industry, Trade and Commerce, Ottawa, Ontario, K1A 0H5.*

Speaking of Trade: Its Effect on Agriculture. November 1978. 106 p. *Available for U.S. $1.50 from Agricultural Extension Services, Institute of Agriculture, Forestry and Home Economics, University of Minnesota, St. Paul, Minnesota, United States, 55108.*

Uniform Variety Tests of Forage Crops. Contributed by researchers in Western Canada, coordinated by R.P. Knowles, Agriculture Canada Research Station, Saskatoon, 1978. 177 p. *Available free from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C5.*

IN REPLY TO AUTHORS AND EDITORS REGARDING AUGUST 1979 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

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(2) An Economic Assessment of Dryland Cropping Programs in the Prairie Provinces: Expected Net Incomes and Resource Requirements
(3) The Economics of Warble Fly Control

1. My comments are on article number (1) (2) (3).
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1 2 3 4 5 6 7 8 9 10

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Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

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THE MULTILATERAL TRADE NEGOTIATIONS AND CANADIAN AGRICULTURE

J.S. Lohoar*

The results of the Multilateral Trade Negotiations (MTN), which have been held in Geneva during the last six years, have recently have announced. Over $1 billion worth of Canadian agricultural exports stand to benefit from concessions negotiated in the MTN. These expanded and more assured export opportunities will benefit all regions and sectors of the agricultural industry. It will be important for the Canadian agricultural and food industry to capitalize on the new market opportunities and ensure that they are transformed into actual sales.

INTRODUCTION

The recently completed Multilateral Trade Negotiations (MTN), sometimes called the "Tokyo Round," were the seventh round of trade negotiations held under the auspices of the General Agreement on Tariffs and Trade (GATT) since the GATT was established in 1947. It has undoubtedly been the largest and most complex trade negotiation ever attempted. Earlier GATT negotiations were essentially limited to tariffs. However, although tariffs were an important and very visible part of the MTN, more emphasis in this round was placed on negotiating improved international rules covering a wide range of non-tariff measures. In addition, emphasis was also placed on the negotiation of several international commodity arrangements to attempt to reduce the extent of price instability on world markets.

Previous GATT negotiations had achieved very little progress in obtaining some liberalization of trade in agricultural products. In the MTN, agriculture again proved to be highly sensitive and difficult to negotiate. Canada, the United States, Australia, New Zealand, and other exporting countries stressed from the outset the importance of an acceptable settlement on agricultural products if the MTN was to be successfully concluded. This would involve improved access to markets, particularly those of the European Economic Community (EEC) and Japan, a greater degree of control over agricultural export subsidies, as well as improved international rules governing trade in farm products. On the other hand, importers such as the EEC, other Western European countries, and Japan continued to stress the need for increased stability in world markets.

The results of the MTN were announced on July 11, 1979 (1). It is therefore now possible to draw some conclusions about their outcome and the impact that the negotiations will have on Canadian agriculture. In view of the complex nature of the negotiations which involved nearly 100 countries and lasted more than six years, it is useful to consider the MTN outcome in terms of its various parts. These include the following:

1. tariff concessions,
2. non-tariff measures, and
3. international commodity arrangements.

TARIFF CONCESSIONS

The agricultural tariff and commodity related non-tariff barrier negotiations were conducted on the basis of bilateral requests and offers, in contrast to the "formula" approach used in the industrial tariff negotiations.

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TABLE 1. ESTIMATED VALUE OF CANADIAN EXPORTS BENEFITING FROM MTN TARIFF CONCESSIONS, BY COMMODITY, SECTOR, AND PRINCIPAL EXPORT MARKET[a]

Commodity	U.S.	EEC	Japan	Other[b]	Total
			$ million		
Grains and Oilseed Products	88.0	–	269.1	–	357.1
Meat and Livestock	353.0	13.4	131.8	2.2	500.4
Dairy	1.3	8.0[c]	–	–	9.3
Fruits and Vegetables	30.0	15.8	0.6	1.3	47.6
Tobacco	2.7	78.5	–	1.6	82.8
Seeds and Nursery Stock	21.2	4.5	–	0.2	25.8
Miscellaneous Agricultural Products	2.9	7.4	0.2	–	10.5
Total	499.0	127.6	401.6	5.4	1,033.6

[a] Based on 1978 exports.
[b] Principally Switzerland, Sweden, Finland, New Zealand, and Australia.
[c] Estimated value of increased exports of aged cheddar cheese.

Canada's major agricultural trade negotiations were with the United States, Japan, and the EEC, and it is estimated that, on the basis of 1978 data, over $1 billion worth of Canadian agricultural exports to these three markets will benefit from MTN concessions (Table 1). The largest gains were made in the U.S. market, where concessions of nearly $500 million were obtained. In return for these concessions, a recent report estimates that Canada's agricultural trade concessions to the United States will have a trade coverage of $423 million (2). Concessions by Japan cover a 1978 trade value of approximately $400 million, of which $252 million represents the binding at free of the tariff on rapeseed and other oilseeds. Although this does not represent an improvement compared with current terms of access, the provision of a binding on these products gives a much greater degree of assurance in relation to future trade. Concessions obtained from the EEC affect exports valued at about $130 million in 1978.

Results by Market

United States

Of particular significance to Canada is the breadth and depth of concessions obtained from the United States. These cover nearly $500 million of imports from Canada and represent about 80 percent of Canada's dutiable agricultural exports to that country. Of this total, about $230 million will enter duty free after the MTN results are fully implemented, and an additional $60 million will be subject to tariff reductions of 50 percent or more. The balance will benefit from tariff cuts of 30 - 50 percent.

In the negotiations with the United States, Canada made major progress in eliminating or significantly reducing several tariff disparities which have been long-standing irritants to Canadian producers and processors. For example, the negotiations will result in the following:

1. the elimination of the high over-quota rates on table and seed potatoes, resulting in Canadian and U.S. rates being matched at 35¢ per 100 pounds;
2. the elimination of the U.S. tariff rate quotas on live cattle and the harmonization of most Canadian and U.S. cattle tariffs at 1¢ a pound; and
3. the reduction and the harmonization of the two countries' tariffs on corn and barley at 5¢ a bushel.

Other products for which reductions and matched tariffs were also obtained include live hogs and most pork products (except canned), beef and veal, most potato products, mustard seed, soybeans, and sunflower seed.

All regions and virtually all sectors of Canadian agriculture will benefit from improved access into the United States, and in many cases specific high priority negotiating objectives requested by individual provinces have been achieved – for example, the request that the United States reduce its rate on "portion control" beef cuts from 10 percent to 4 percent. Moreover, notwithstanding the separate GATT Article XXVIII renegotiations involving a net increase in the protection for Canada's fruit and vegetable growers and processors, Canadian horticulture will also benefit from significant U.S. tariff reductions as a result of the MTN.

In the agricultural settlement with the United States, Canada made smaller tariff reductions than the United

States, but for a relatively larger volume of trade. However, some of the Canadian concessions involve only the binding of rates which had been unilaterally reduced for some time.

Japan

While Japan did not respond to several Canadian requests, Canadian agriculture did obtain benefits covering about $400 million of exports. These included rapeseed, rapeseed oilcake and oil, mustard seed, pork, frozen and canned corn, and edible offals. Canada also has an opportunity to compete for an expanded grain-fed beef quota. The major gain in the Japanese market came through obtaining tariff bindings and, in most cases, tariff reductions on a range of products which were previously not subject to GATT bindings. When a tariff has been bound, a further negotiation is required and compensation must be paid if it is subsequently increased.

The EEC

Limited but significant concessions were obtained from the EEC covering about $130 million worth of Canadian agricultural exports. Major items include tobacco; edible offals; frozen, wild blueberries; canned and frozen corn; maple syrup; and dried peas and beans. In addition, an improved access agreement for aged Canadian cheddar cheese was negotiated, involving establishment of a special quota of 2 750 tonnes (6.1 million pounds) at a reduced minimum import price and a reduced, fixed levy, compared with the existing system which has restricted Canadian cheddar exports to less than 500 tonnes a year. Moreover, the new agreement will permit sales of Canadian cheddar in retail as well as wholesale packs. In return for this improved access and an EEC undertaking not to undercut Canadian cheese prices through the EEC's cheese export subsidy system, Canada agreed to the following:

1. the current Canadian global cheese import quota of 45 million pounds will be maintained, subject to review in 1982; and
2. Canada will not disrupt internal EEC cheese prices.

Since the EEC was not prepared to negotiate any fundamental changes in the nature of its Common Agricultural Policy, there will be no changes in the EEC's system of variable import levies which will continue to govern Canada's major grain exports, particularly wheat and barley.

Other Countries

In addition to obtaining new or more secure access for a wide range of agricultural products in the three major markets, Canadian agriculture will also benefit from a more limited number of concessions to some of the smaller export markets, particularly New Zealand, Australia, the Nordic countries, and Switzerland. The concessions negotiated in these markets include tobacco (Australia and Finland), canned or frozen corn or both (Switzerland, Sweden, and Finland), fed beef (Switzerland), apples (Finland), and fresh or frozen pork (New Zealand). Negotiations with some developing countries are still continuing.

Results by Sector

Grains and Oilseeds

United States

The Canadian-U.S. tariff negotiation will yield significant benefits for Canadian oilseed and oilseed product exports. The United States will eliminate its tariffs on soybeans, mustard seed (exports valued at $11 million in 1978), and sunflower seed ($0.9 million). It will also reduce the rates on flaxseed from 50¢ to 23¢ a bushel ($5.5 million), on rapeseed from 1¢ to 0.4¢ a pound, on edible rapeseed oil from the present duty of 2.4¢ a pound to the reduced rate of 7.5 percent, on hydrogenated rapeseed oil from 5¢ a pound to 9 percent, and on corn oil from 10 percent to 4 percent. The United States will also eliminate the 2¢ a pound tariff on ground mustard. The results, by eliminating or significantly reducing several tariff disparities, will benefit Canadian oilseed producers and processors, particularly in the Prairie Provinces. The respective concessions on vegetable oils will not be initiated until 1983.

The United States will make a major reduction on its tariff on corn from 25¢ a bushel to 5¢ a bushel. The Canadian tariff on corn, currently 8¢ a bushel, will be reduced to the same 5¢ level. The U.S. tariffs on oats ($1.4 million), rye ($0.5 million), and certified seed corn ($2.6 million) will be eliminated and the tariff on barley for malting purposes ($13 million) reduced from 7.5¢ a bushel to match the Canadian tariff at 5¢ a bushel.[1] The U.S. tariff of 10 percent on wheat gluten will be reduced to 4 percent for animal feed use and to

[1] There will be no change in the Canadian Wheat Board import permit system for wheat, barley, and oats.

8 percent for other use. In 1978 Canada exported \$6.5 million worth of wheat gluten to the United States.

The competitive position of the Canadian bakery industry should be significantly enhanced by the elimination of the U.S. tariffs on biscuits and cakes (\$27 million) and macaroni and similar pasta products (\$10.7 million).

The EEC

Since the EEC was not prepared to negotiate any fundamental changes in the nature of its Common Agricultural Policy, the MTN will lead to no change in the EEC's system of variable import levies which will continue to govern Canada's major grain exports, particularly wheat and barley. However, Canada still has outstanding GATT rights on quality wheat resulting from the formation of the six-member EEC and its subsequent enlargement to nine member states. As a result of the MTN, Canada and the EEC have agreed to meet in 1982 to examine the question of the disposition of Canada's outstanding GATT rights regarding exports of quality wheat to the EEC.

Japan

Japanese wheat and barley imports, administered by the Japanese Food Agency, will continue to enter duty free. Canada exported \$281 million worth of wheat and barley to Japan in 1978.

Japan has offered to bind duty free entry for rapeseed (\$241 million), soybeans (\$9.5 million), mustard seed (\$2.8 million), and rapeseed oilcake (\$1.6 million).

Japan will also reduce and bind the tariffs on rye from 15 percent to 7 percent (\$6.5 million), rapeseed oil from 20 yen/kg to 17 yen/kg (\$7.8 million), and vegetable protein from 25 percent to 12.5 percent.

The statutory Japanese tariff rates for mustard flour and prepared mustard have been reduced from 30 percent (temporary rate 20 percent) to 15 percent for retail packs and from 25 percent (temporary rate 16 percent) to 12.5 percent for other pack sizes. The Japanese tariff for unsweetened biscuits and cookies and crackers (excluding rice products) is being reduced from 35 percent to 30 percent and for sweetened biscuits and cookies and crackers from 40 percent to 34 percent.

Status of the International Wheat Arrangement

Negotiations on a new International Wheat Arrangement were conducted separately from the MTN. These negotiations have as yet not been successful and have been postponed indefinitely. They will be resumed as soon as conditions necessary for a successful conclusion appear to exist.

Livestock, Meat, and Meat Products

United States

Canada obtained major concessions from the United States on live cattle and portion control beef cuts. In most instances, the generally higher U.S. cattle tariffs will be reduced from present rates of $1\frac{1}{2}$¢ to $2\frac{1}{2}$¢ a pound and matched with Canadian tariffs at a new, lower level of 1¢ a pound. The U.S. concessions include the removal of tariff rate quotas on live cattle under 200 pounds and over 700 pounds. Canadian exports of live cattle in this category in 1978 totaled \$108 million. Negotiations on the U.S. tariff for live cattle from 200 to 700 pounds are continuing.

On portion control beef cuts, the United States used its maximum Trade Act authority to cut the tariff from 10 percent to 4 percent, a concession which should enhance Canada's ability to supply the large hotel, restaurant, and institutional trade in the United States. This also significantly reduces the large differential between U.S. and Canadian tariffs on this high value product. Sales of portion control beef cuts will, like most other beef shipments from all countries, come within the volumes permitted to be imported under the U.S. Meat Import Law. U.S. and Canadian tariffs on fresh, chilled, or frozen beef and veal will be reduced from 3¢ a pound to 2¢ a pound (\$73 million Canadian exports in 1978) and the U.S. 0.7¢ a pound tariff on cows for dairying (\$2 million) will be eliminated as a result of the MTN.

Because of the U.S. tariff reduction on pork, duties on Canadian exports of prepared or preserved pork products (except sausages), unboned, uncooked, and packed in airtight cartons, will be reduced from 2¢ a pound to 1¢ a pound. The tariff on pork sausages will be cut from 1.6¢ or 1.625¢ a pound to 0.6¢ a pound (\$4.2 million).

The U.S. tariffs on live horses, valued at more than \$150 a head (\$50 million), edible meat offals (\$2 million), cattle semen (\$2 million), live hogs (\$25 million), and fresh or frozen pork (\$49 million) will be eliminated.

The EEC

EEC tariff reductions and bindings of interest to Canadian exporters of livestock, meat, and meat products include edible beef and pork offals, from 7 to 9 percent

to 4 percent, and pork and beef livers, from 11 percent to 7 percent (accounting for more than $10 million worth of exports in 1978). Small tariff reductions were also made on certain animal fats.

Canadian exporters of high quality fed beef will be able to compete for part of a global "hotel" beef quota of 10 000 tonnes which the Community will establish at a fixed tariff of 20 percent (i.e., no levy).

Japan

Japan has offered to bind duty free entry for several products including tallow (in 1978 exports were $11.3 million), breeding cattle ($3.7 million), and horsemeat ($4.4 million). They are also binding the current tariff on frozen sausages.

Japan will also reduce and bind the tariffs on edible beef offals from 25 percent to 15 percent ($1.3 million), and for chicken legs to 10 percent and turkey meat to 5 percent.

In addition, Canada obtained on an unbound basis a reduction of fresh and frozen pork from 10 percent to 5 percent, plus a variable component in certain circumstances. In 1978 Canadian exports of fresh and frozen pork to Japan totaled $110 million. Canada will also have the possibility of competing for a share of an enlarged Japanese quota for grain fed beef which will increase to 30,000 tons by 1982.

Dairy Products

The United States

The United States will reduce its tariff on unprocessed cheddar cheese from 15 percent to 12 percent and on processed cheddar from 20 percent to 16 percent. In 1978 Canada exported $1.3 million worth of cheddar cheese to the United States. The U.S. tariffs on Swiss type cheeses will be reduced from 8 percent to 6.4 percent and on certain Italian type cheeses from 10 percent to 7.5 percent. In 1978 Canada exported $33,000 worth of Swiss type cheese to the United States. The United States will also reduce the current tariff of 1.3¢ a pound for certain casein mixtures to 0.2¢ a pound.

After the MTN, however, Canadian exports of most types of cheese to the United States will be limited by quotas to 2 044 tonnes (4.5 million pounds) a year. Of this total, 833 tonnes (1.8 million pounds) is reserved for aged Canadian cheddar, 70 tonnes (154,000 pounds) for Swiss type cheeses, and the remaining 1 141 tonnes (2.5 million pounds) is to be allocated to other cheeses not specifically provided for. If it is necessary in order to fill these quotas, Canada will be able to price cheese exports to the United States down to the U.S. wholesale price for similar cheese without fear of countervailing action. Soft cured cheeses, e.g., Camembert, Brie, Oka, and cheeses made from sheep or goat's milk are exempt from these quotas.

The EEC

As indicated above, within the MTN a new arrangement for the export of aged Canadian cheddar cheeses was worked out with the Community. The new terms of access should assist Canadian exporters to re-establish their trade, particularly in the U.K. market. Since the United Kingdom joined the EEC in 1973, Canadian exports of cheddar cheese to that country have averaged less than 500 tonnes, well below pre-accession levels. The arrangement provides that adjustments will be made in the levy charged against Canadian cheddar cheese to ensure that the quota can be filled.

Fruits and Vegetables

The United States

Canada won from the United States important concessions in the fruit and vegetable sector. For many years the United States has imposed a tariff rate quota system on seed and table potatoes whereby the "within-quota" tariff was 37.5¢ per 100 pounds and the "over-quota" tariff 75¢ per 100 pounds. A long-standing objective of the Canadian industry has been to eliminate this system. In the MTN the United States agreed to eliminate the quotas and to match the tariffs with Canada at 35¢ per 100 pounds. Canadian exports of seed and table potatoes amounted to $6.7 million in 1978. In addition, the U.S. tariff on prepared potato products, including frozen french fries, has been reduced from 17.5 percent to 10 percent and matched with the corresponding Canadian rate. Canadian exports of these products in 1978 were 1.4 million. The U.S. tariff for fresh or frozen carrots of 6 percent will be reduced to 1¢ a pound for baby carrots and 0.5¢ a pound for other carrots. In 1978 Canada exported carrots valued at $4.8 million to the United States.

The United States is a key market for fresh and frozen blueberries which, as a result of the MTN, will enter duty free. In 1978 Canada exported about $4.2 million worth of fresh and $10 million worth of frozen blueberries to the United States.

Canada obtained tariff cuts on other fruits and vegetables, including 60-percent reductions on prepared or

preserved onions, frozen cranberries, fiddleheads, and cut-up rutabagas and 50 percent on frozen raspberries.

The EEC

EEC fruit and vegetable tariff reductions and bindings of interest to Canadian exporters include those on frozen wild blueberries from 20 percent to 4 percent ($2.8 million in 1978), canned and frozen corn from 13 percent with a variable component to 8 percent with a variable component ($10.5 million), and on seed potatoes from 9 percent to 7 percent ($1.1 million). In addition, the EEC will reduce the tariff on apples imported between January 1 and March 31 each year from 10 percent with a minimum of 1.7 European Units of Account (EUA) per 100 kg to 8 percent with a minimum of 2.3 EUA per 100 kg.

Japan

Japan agreed to reduce and bind the tariffs on frozen and canned corn from 25 percent to 12.5 percent ($0.2 million), and frozen berries (excluding strawberries) from 20 percent to 10 percent ($0.1 million).

Canada has also obtained a new tariff binding at the current level of 10 percent on frozen vegetables (excluding potatoes). Canada exported $204,000 worth of these products to Japan in 1978.

Article XXVIII Negotiations

On March 12, 1979 Canada introduced a revised tariff schedule for a range of fruits and vegetables following the Tariff Board's detailed study of the industry and extensive renegotiations with our trading partners. These negotiations were conducted separately from the MTN under the provisions of GATT Article XXVIII. This article allows for the increase of tariff rates, provided that adequate compensation is negotiated with trading partners adversely affected by the changes.

These tariff changes included increases in tariff protection for most fresh produce during the domestic marketing season and removal of the duty in the off-season when Canadian produce is not available. Increased protection was provided for most processed products which have been subject to specific (cents per pound) rates of duty by replacing them with ad valorem rates designed to recapture some of the protection "lost" as a result of rising prices.

There were also several tariff decreases as a result of the Tariff Board's report and the renegotiations with our trading partners. These were implemented on March 12, while the tariff increases were scheduled to be put in effect on October 1, 1979. The tariff bill (Bill C-51) was given first reading on March 19 but was not approved before Parliament was dissolved. The tariff decreases have been effectively continued by Order in Council under section 17 of the Financial Administration Act. The tariff bill to establish the higher tariff rates is expected to be introduced shortly after the opening of Parliament on October 9, 1979.

Tobacco

The United States

Both Canada and the United States will set their tariffs for Virginia type tobaccos at 12.75¢ a pound for unstemmed and 20¢ a pound for stemmed. The U.S. tariff on stemmed will be reduced from 40¢ a pound to 20¢ a pound, while the corresponding Canadian tariff will be reduced from 30¢ a pound to 20¢ a pound. For unstemmed, Canada will reduce its 20¢ a pound tariff to the existing U.S. rate of 12.75¢ a pound. In addition, the United States has given Initial Negotiating Rights to Canada for both of these items. This means that the United States cannot change these tariffs without first negotiating with Canada, regardless of the actual amount of trade involved.

In 1978 the United States imported $2.7 million worth of these types of tobacco from Canada; corresponding Canadian imports from the United States were valued at $8.1 million.

The EEC

After wheat and barley, tobacco is Canada's third largest agricultural export to the EEC. The EEC will consolidate three existing tariff items into one with an effective maximum specific duty of 30 EUA per 100 kg (21.9¢ a pound), compared with the existing maximum duty of 45 EUA per 100 kg (32.8¢ a pound) which applies to most of Canada's unmanufactured tobacco exports. In 1978 Canadian tobacco exports to the EEC totaled $78.5 million.

Seeds and Nursery Stock

The United States

U.S. tariffs on some forage seeds of interest to Canada will be eliminated. These include alsike, red, sweet, and other clover ($6.2 million) and creeping red fescue seed ($7.4 million). The U.S. tariffs on nursery stock with earth attached were reduced from 5.5 percent to 2.2 percent and from 7.5 percent to 3 percent. Canadian exports of nursery stock expected to benefit from this

concession were estimated at $3.3 million in 1978. The U.S. tariff on fresh-cut flowers is being reduced from 10 percent to 8 percent. Canada exported almost $1 million worth of cut flowers to the United States in 1978. The U.S. tariff of 9¢ a pound on onion seed is being eliminated.

The EEC

The EEC will reduce its tariff on grass seeds, including meadow fescue, rye grass, timothy, red fescue, cocksfoot grass, and bent grass from 6 percent to 4 percent. In 1978 Canada exported $4.5 million worth of these seeds to the EEC.

Miscellaneous Agricultural Products

The United States

The United States will remove the current tariff of 2 percent on bovine hides and skins in pieces and on whole calf hides or skins ($1.5 million). The tariff on feathers and downs, other than ostrich, imported by the United States will be reduced from 15 percent to 7.5 percent ($729,000). The U.S. will also lower its tariff on certain flavoring extracts and nonalcoholic fruit flavors from 6 percent to 2.4 percent, and remove the 0.4¢ a pound tariff on split dried peas.

The EEC

Although the current duty-free status is expected to continue, the EEC's reduction in the bound rate for peas and beans from 4.5 percent to 3 percent will provide added security for Canadian growers and exporters. In 1978 Canada exported peas and beans to the EEC valued at $7.1 million. The EEC tariff on maple syrup will be reduced from 20 percent to 10 percent. EEC imports of maple syrup from Canada in 1978 were valued at $319,000.

Japan

The Japanese tariff for dried peas will be reduced from 12 yen/kg with an ad valorem equivalent (AVE) of 15.9 percent to 10 percent.

Canadian Tariff Concessions

These improved opportunities for Canada's agricultural exports were of course not free; nothing is given away in a trade negotiation. The cost, however, in terms of protection foregone by Canadian agriculture, will not be as great as some feared. For example, there are no changes in the Canadian global import quota levels for cheese, eggs, and turkeys. A minimum quantitative access commitment of 139.2 million pounds has been offered on beef and veal, but this volume is below the existing annual restraint level.

Several Canadian agricultural tariff concessions reflect the binding of the "temporary" tariff reductions which have been in effect since 1973. Moreover, most tariff cuts will be phased in during an eight-step, seven-year period, which should give Canadian producers and processors enough time to adjust to the new competitive conditions. An estimate of the value of imports on which tariff concessions were made is in Table 2.

TABLE 2. ESTIMATED VALUE OF TRADE AFFECTED BY MTN TARIFF CONCESSIONS OFFERED BY CANADA, BY COMMODITY SECTOR[a]

Commodity Sector	Value
	$ million
Grains and Oilseed Products	212.1
Meat and Livestock	358.3
Dairy	–
Fruits and Vegetables	87.9
Tobacco	15.3
Seeds and Nursery Stock	17.9
Miscellaneous Agricultural Products	186.4
Total	878.0

[a]Based on 1978 imports.

NON-TARIFF MEASURE AGREEMENTS AFFECTING AGRICULTURAL TRADE

In addition to the commodity-related tariff and non-tariff barrier negotiations, the MTN resulted in agreement to elaborate, interpret, and modify some of the general trading rules governing world agricultural and industrial trade. In particular, international codes have been negotiated on subsidies and countervailing duties, anti-dumping duties, technical barriers to trade (i.e., standards), import licensing procedures, and customs valuation. These new rules or codes should give much greater assurance and certainty of access to foreign markets and gradually provide more effective procedures for resolving problems in these areas.

Of these non-tariff measure agreements, the most significant to agriculture is the Agreement on Subsidies and Countervailing Duties. U.S. application of the subsidies and countervailing duties code will be a major gain for Canada. When the U.S. law is brought into conformity with the code it will be necessary for the United States to demonstrate injury before countervailing duties can be levied against Canadian exports

indirectly benefiting from government assistance, e.g., DREE grants to food processors or commodity price support payments. This is not now the case in the United States for dutiable goods and constitutes a major irritant and non-tariff barrier.

The Agreement on Subsidies and Countervailing Duties contains a special section dealing with agricultural export subsidies. Although agricultural export subsidies are not prohibited, the new agreement provides some modest but worthwhile improved international disciplines. For example, there will be better recourse to the GATT dispute settlement machinery if subsidized exports displace Canadian exports in individual third markets (under the existing rules Canada had to prove that its share of world trade had declined). In addition, the agreement states that signatories shall not grant agricultural export subsidies to individual markets in a manner which "results in prices materially below those of other suppliers to the same market." In other words, subsidized exporters should not lead the market down by engaging in predatory export subsidization.

MULTILATERAL COMMODITY ARRANGEMENTS

In addition to the bilateral request-and-offer negotiations on agricultural products, multilateral commodity arrangements for dairy products and beef were agreed upon as part of the MTN. These will provide new intergovernmental consultative mechanisms which can be expected to improve international market monitoring and analysis of these sensitive sectors, and encourage cooperative solutions (as opposed to unilateral actions) in the event of extreme market situations.

An International Dairy Arrangement has been negotiated to maintain greater stability in world trade for dairy products. It provides for the establishment of an International Dairy Products Council, under which members will exchange information and engage in consultations related to trade in dairy products. This arrangement contains minimum export price provisions for certain milk powders, milk fat, and particular types of cheese. Canada's willingness to adhere to the milk powder arrangement is conditional upon our ability to continue to market traditional quantities of skim milk powder in Mexico and the Caribbean rim.

The International Arrangement for Bovine Meat is essentially an instrument for exchanging information and carries no economic obligations. It is expected that this new information exchange and consultation mechanism will provide improved and more timely market information for the beef sector, and assist in reducing the instability and fluctuation in prices which has characterized the world beef market in recent years.

Agreement was also reached that further consideration will be given, within the GATT framework, to establishing improved consultative measures which would deal with future problems in the agricultural sector.

CONCLUSION

The Tokyo Round of trade negotiations had led to improved terms of access for Canadian agricultural exports amounting to over $1 billion, approximately one fifth of total farm exports. The agreements reached on non-tariff measures, particularly export subsidization and countervailing duties, can also be expected to provide greater assurances for future agricultural exports. The international commodity arrangements for dairy products and beef should contribute to greater stability in world markets for these products.

The outcome of the MTN is a first step in obtaining some liberalization in international trade in farm products. Although many problems remain, the results will determine the trading framework facing Canadian agriculture for much of the 1980s and 1990s. The new, expanded and more certain export opportunities which have been opened up should benefit virtually all sectors of the agricultural industry. The results of the negotiations, however, represent a beginning, not an end. It will now be up to the Canadian agriculture and food industry to capitalize on the new market opportunities which the MTN have provided and to transform these opportunities into actual sales.

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VARIABILITY OF HIGH PROTEIN MEAL PRICES

J.W. Duncker*

World prices of high protein meal have shown great variability during the last eight years, even more than those of cereals. This has been due to peculiar supply and demand factors. World meal price behavior during the next five years might be less erratic.

INTRODUCTION

High protein meal (meal) prices have been erratic since 1971. Meal prices have fluctuated even more than those of cereals in world markets. Identifying and weighing factors which determine meal prices in world markets helps to develop a more analytical market outlook for oilseeds and their products. It also contributes to the development of policies and programs to assist in balancing the growth of Canada's oilseed industry.

This paper discusses some of the factors and relationships which affect meal prices. It also analyzes differences between meal and cereal (particularly coarse grain) price behavior by tracing differences in their supply and demand patterns. Meal and feed grains have many links. They are combined in feed rations, and oilseeds and feed grains often compete for the same land. After a more analytical understanding of this framework, information about one will help explain or predict the behavior of the other.

Meal is derived from a variety of sources, mainly of vegetable origin. More than 90 percent of the world's meal production originates in a few oil-bearing plants, i.e., soybean, peanut, sunflower, cotton, and rapeseed. Meal is the cake left after the oil is extracted from the seed. One non-vegetable source is fish meal; its relative importance has been declining, however, because the seas' resources are not increasing. Meal from other animal sources, such as meat, bones, blood, and feathers, is economically less important, as are brewery by-products and synthetic products.

Meal is often considered a by-product of oilseed processing because in most oilseeds it is second in value to the extracted oil. It is dominant, however, in the soybean, both in volume (80 percent) and value (60-65 percent). Soybeans are the source of about 65 percent of the world's meal production and account for 75 percent of the world's meal exports (Table 1). During the past two decades there has been a significant production increase in meal, mainly because of the spectacular increase in world soybean production. The production increase first occurred in the United States, and more recently in South America.

Use of meal is a relatively modern phenomenon. Because of its high protein content (35-50 percent), meal is mainly used in feeding livestock and poultry. Protein, a combination of amino acids (different combinations occur in different meals), generally provides the material for physical animal growth. This is in contrast to (but complementary to) other feedstuffs – mainly feed grains – which are primarily energy sources.

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TABLE 1. WORLD PRODUCTION AND EXPORTS OF MEAL[a]

Meal	1973	1974	1975	1976	1977	1978
			percent			
Production[b]						
Soybean Meal	57.3	61.1	58.0	62.8	61.3	64.1
Fish Meal	9.1	8.8	9.4	8.8	8.7	7.3
Peanut Meal	6.8	6.1	6.6	6.8	6.7	5.7
Sunflower Meal	5.6	5.9	5.5	4.6	5.1	5.3
Cottonseed Meal	12.4	10.7	11.8	8.9	10.5	9.7
Linseed Meal	1.7	1.5	1.6	1.5	1.4	1.6
Rapeseed Meal	2.7	3.9	4.6	4.4	3.9	4.0
Others	2.4	2.0	1.5	2.3	2.4	2.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
(Total, '000 Tonnes)	(58 100)	(68 950)	(64 360)	(72 650)	(66 320)	(78 850)
U.S. Share of Total	49.1	49.4	42.1	46.1	42.3	47.3
U.S. Share of Soy Meal	77.6	74.7	66.1	68.9	63.2	67.7
Brazil's Share of Soy Meal	11.0	13.8	19.6	17.5	21.8	14.5
Exports						
Soybean Meal	69.9	73.8	72.7	74.1	75.7	75.6
Fish Meal	7.3	8.5	9.9	7.8	7.0	6.4
Peanut Meal	8.7	6.7	6.7	8.3	6.5	6.2
Sunflower Meal	2.3	2.0	1.6	1.7	2.0	2.7
Cottonseed Meal	4.0	2.9	3.0	2.1	2.2	2.5
Linseed Meal	2.2	1.7	1.8	1.6	2.0	2.0
Rapeseed Meal	2.8	2.1	1.5	1.8	2.1	2.1
Others	2.8	2.3	2.8	2.7	2.6	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
(Total, '000 Tonnes)	(25 960)	(27 640)	(27 590)	(33 590)	(32 660)	(35 760)
U.S. Share of Total	58.7	59.2	51.0	51.9	52.4	51.1
U.S. Share of Soy Meal	82.3	78.4	68.3	68.5	67.1	64.8
Brazil's Share of Soy Meal	16.5	20.6	28.8	29.1	28.7	23.0

[a] Forty-four percent soybean meal equivalent.
Adapted from various USDA Foreign Agriculture Circulars.
[b] Production available.

Meal is used almost wholly as an ingredient in livestock and poultry rations. The growth of livestock feeding is largely linked to increased demand for livestock products in the industrial world, and more recently in the new oil-rich countries, due to their rising real incomes and living standards. In many areas land resources and traditional feeding practices have become insufficient to meet this growing demand. Hence, livestock and poultry feeding is becoming more sophisticated. Livestock rations are increasingly being produced commercially and on a large scale. Technological developments during the past two decades permit analysis of feed ingredients and their compounding to achieve nutritionally balanced least-cost combinations of ingredients. In many areas ingredients have to be imported.

The importance of meal production (meal basis) is increasing in Canada. Not only is the production of rapeseed and soybeans increasing but the quality of rapeseed meal, use of which still meets some resistance, is improving. This improvement in quality has stimulated demand and therefore augmented the value of rapeseed meal and rapeseed and will continue to do so in Canada and abroad.

Canadian soybean and rapeseed meal supplies for internal use and for export will remain only a minor source of total world supplies and world export supplies of meal. Their pricing, and the income of Canadian producers from the meal equivalent of their oilseed crops, will therefore be strongly influenced by world market prices for meal.

HISTORICAL PRICE BEHAVIOR OF MEAL

Before 1972, prices of meal, corn, and wheat were relatively low and steady compared with subsequent levels. Increased inflation (particularly in the United

States), floating exchange rates, commodity speculation, nationalist tendencies, the fuel oil crises, recurring recession, all factors interdependent to some extent, have since had an unsettling impact on meal demand, supply, and prices. In 1972, prices of all categories of feed ingredients increased strongly; however, the increase for meals was much steeper than for cereals. In May 1973 the soybean meal price in Decatur reached U.S. $342 a ton, compared with $105 in June 1972, a jump of about 325 percent. In contrast, not until January 1974 did the wheat price increase 200 percent, and not until October 1974 did corn prices increase 200 percent.

The 1972 meal price increase was mainly due to a drastic decline in fish meal production in Peru and decreased groundnut meal production in West Africa which were not offset by the small increase in U.S. soybean supplies. The ensuing world supply tightness was aggravated by large soybean exports from the United States, mainly to the U.S.S.R. Wheat and corn prices also increased because of large wheat shipments to the Soviet Union. Soybean and cereal shipments to that country in particular had a strong speculative price effect. Recently the Soviet Union and Eastern Europe have been more committed to improving their living standards, especially by increasing the supply of meat products. The added demand potential for meal from the communist world which, in contrast to cereals, has not been regulated also contributed to meal price volatility.

During 1974 and 1975, prices of meal, feed grains, and wheat basically moved together. However, a profit squeeze in the livestock industry and decreasing numbers of poultry and hogs affected prices of both cereals and high protein meals. Reduced world supplies of meal (the 1974 U.S. soybean crop decreased more than 20 percent) and cereals temporarily drove up prices towards the end of 1974. A serious downturn in the business cycle during most of 1975 again lowered prices. This recession tended to decrease world meat demand and therefore the (derived) demand for feed ingredients. The overall price decrease from 1973 to 1975 for meal was larger than that for wheat and feed grains.

Meal price behavior differed from that of wheat and feed grains in 1976 and 1977. The anticipation, and later the realization, of meal supply shortages, because of reduced 1976 soybean plantings in the United States, were the principal causes of increased soybean prices during 1976 and early 1977. However, feed grain supplies became ample during the same period. Wheat and corn prices actually declined. The lack of price cohesion of meal and corn, the two major feed elements, probably indicates a lack of substitutability of one for the other. If corn could satisfactorily replace meal, the steep price increase of meal would probably not have occurred. This is in line with the different nature of the two feed ingredients. Further questions which this raises about the relationships between the demand for meal and for feed grains are discussed in a subsequent section.

Brazilian meal exports and the anticipation of a large 1977 U.S. soybean crop again lowered meal prices in 1977. However, the large decrease in North American exchange rates near the end of that year drove up cereal and meal prices in U.S. dollars, and depressed prices in the currencies of Western Europe and Japan. Use abroad increased and somewhat balanced the increase in 1978 North American cereal and oilseed production.

Hence the evidence indicates that meal prices generally fluctuate more than cereal prices and sometimes move independently from them.

WORLD SUPPLY, DEMAND, AND TRADE

The differences in 1977-78 production and trade patterns between meal and feed grains are striking (Table 2). World meal production of 84 million tonnes (82 million tonnes of 45 percent soybean meal equivalent) is dwarfed by world coarse grain production of 700 million tonnes, of which only a small percentage is used for food.

Trade (relative to production) is much more prominent in the meal sector than in the coarse grain sector. Only 12 percent of world coarse grain production is exported, whereas meal exports comprise about 45 percent of world meal production.

Meal is produced in fewer countries and production is less equitably distributed than are feed grains. There is generally less self-sufficiency in importing countries and export availabilities are proportionally larger in exporting countries. Comparatively larger shipments are necessary to draw down surpluses and to meet shortages in different areas.

The United States produces about 30 percent of the world's coarse grains but almost 50 percent of the world's meal. Therefore, external demand for meal has to be met more by U.S. export availabilities than external demand for coarse grains. The United States

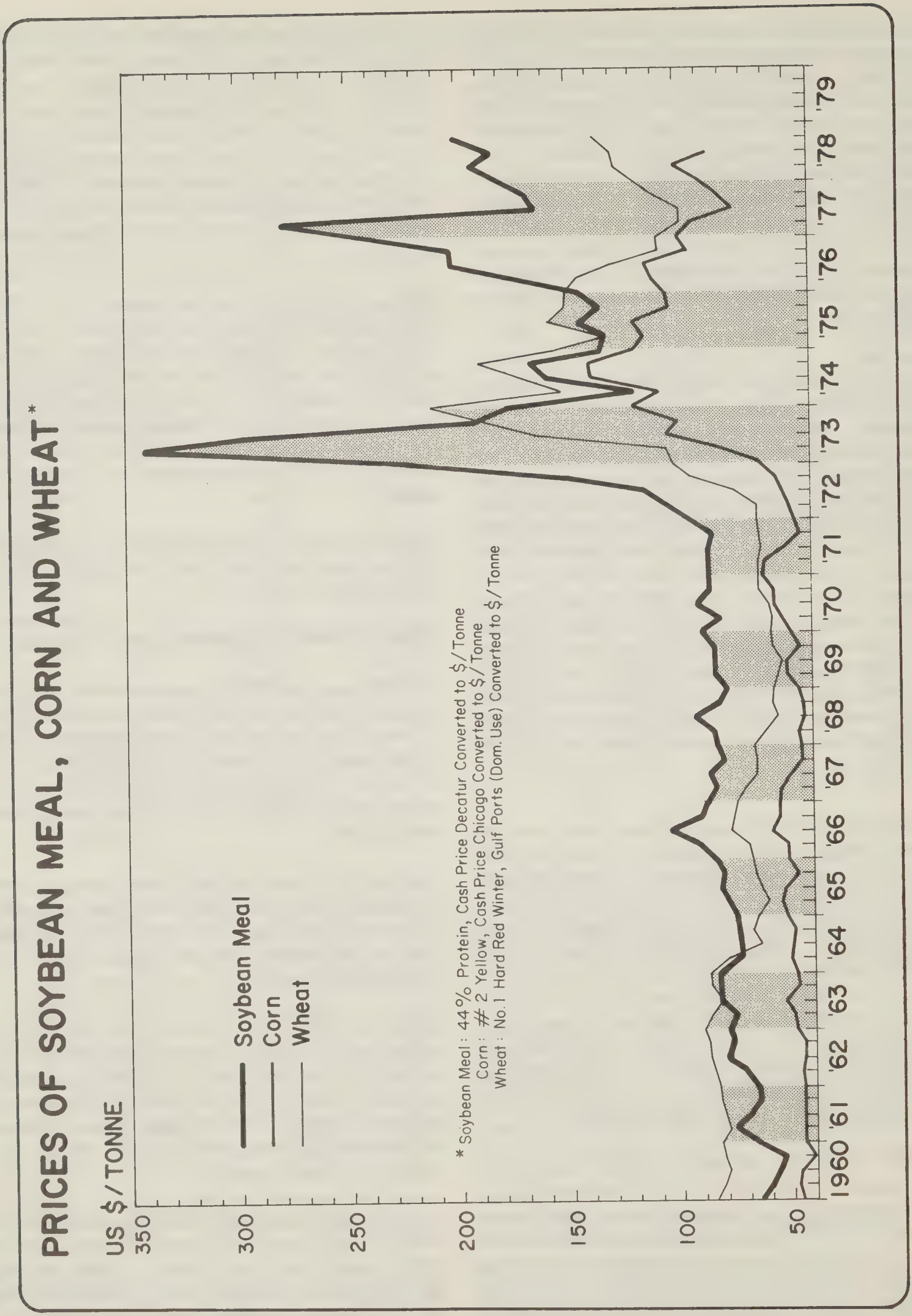
PRICES OF SOYBEAN MEAL, CORN AND WHEAT*
US $/TONNE
350
300
250
200
150
100
50
1960 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78 '79
Soybean Meal
Corn
Wheat
* Soybean Meal : 44% Protein, Cash Price Decatur Converted to $/Tonne
Corn : # 2 Yellow, Cash Price Chicago Converted to $/Tonne
Wheat : No. 1 Hard Red Winter, Gulf Ports (Dom. Use) Converted to $/Tonne

TABLE 2. COMPARATIVE PRODUCTION AND TRADE OF COARSE GRAINS AND HIGH PROTEIN MEAL

Area	Coarse Grains[a]			High Protein Meal[b]		
	Production	Gross Exports	Gross Imports	Production	Gross Exports	Gross Imports
	million tonnes					
Canada	22.4	3.8	—	1.8	1.1	.6
Australia	4.2	1.9	—	—	—	—
Argentina and Paraguay	17.8	11.0	—	3.3	3.4	—
South Africa	10.8	2.8	—	.3	—	—
West and Central Africa	—	—	—	1.3	.8	—
South East Asia	2.2	1.3	—	6.2	2.1	—
Brazil	14.4	1.0	—	7.7	6.0	—
Western Europe (EEC and Spain)	87.4	5.8	25.2	1.6	.9	22.4
Japan	—	—	17.0	.7	—	4.3
U.S.S.R.	92.6	1.0	11.7	5.6	—	1.0
Eastern Europe	59.4	—	8.2	1.4	—	1.5
United States	203.8	52.1	—	40.8	21.8	—
China	—	—	0.1	6.7	.1	—
Others	182.0	2.2	20.9	6.6	1.8	8.6
Total	697.1	83.0	83.0	84.0	38.0	38.0

[a] Adapted from Foreign Agriculture Circular FG 2079, F.A.S., USDA, Washington.
[b] Adapted from Food and Agriculture Organization C.C.P. OF/ST 79/4, REV. 1.

exports more than 50 percent of its meal production (meal basis) but only about 25 percent of its coarse grain production.

Soybean production in South America, particularly in Brazil, has lately become a mitigating factor. However, soybeans in Brazil (as in the United States) are grown in a limited area, and are therefore vulnerable to the changing weather.

The European Economic Community (EEC) imports less than 20 percent of its feed grain requirement (4 percent of world production, 30 percent of world trade). Cereal production is supported in the EEC and imports are levied, but it imports virtually all of its meal requirements which are imported duty free (about 25 percent of world production, more than 50 percent of world trade), mainly through the Netherlands and West Germany.

The U.S.S.R. and Eastern Europe import about 13 percent of their coarse grain needs (2 percent of world production, 24 percent of world trade). The Soviet Union and Eastern Europe import relatively small quantities of meal, despite their large and growing livestock establishments. This is possibly due to the large wheat and feed grain imports required and the less developed feeding practices. The U.S.S.R. has a large cattle industry for which lower grade wheat, which is produced in large quantities, is a sufficient protein provider. Meal is more expensive and less vital for livestock production and human consumption than feed grains and wheat.

Japan, contrary to Western Europe, is equally dependent on meal and feed grain imports. However, its meal imports, in terms of world production, are larger.

World meal exports then, are more concentrated in the United States and imports are more concentrated in Western Europe than the coarse grain equivalents.

The extensive trade resulting from the concentration of world meal production and the distribution of meal demand is conducive to a high degree of price instability. There is little offsetting supply for a potential decrease in oilseed production in the United States, although production is increasing in South America. Likewise, a rise or fall in demand for meal in the EEC, because of economic or climatic causes, is not usually mitigated by changes in demand elsewhere, notwithstanding increasing demand in Eastern Europe and perhaps the U.S.S.R.

Because of the higher geographical concentration, world meal supply and demand tend to be more variable from

year to year than the feed grain equivalents. This tends to make meal prices more unstable than feed grain prices. In economic terms, both the curves of meal demand and supply tend to shift to a larger extent.

Meal and edible oil are generally produced together. However, soybean meal and fish meal (even more so) are dominant products, both in quantity and value, compared with their co-products soybean oil and fish oil. Soybeans are produced and fish are caught primarily for meal. Soybean meal and fish meal combined occupy 70 percent of world meal production and 80 percent of world meal exports. Therefore world meal supplies tend to react to and to adapt largely to meal prices. The complementary production of edible oils, through its price and the crushing margin has a minor disturbing effect on meal production and therefore meal prices.

MEAL UTILIZATION

Meal in Feed Production

The demand for meal from the final consumer of meat and meat products is indirect. In terms of volume, meal is only a relatively small input into livestock feeding. Protein requirements in the cattle sector are generally not more than 10 percent of feed rations, in the hog sector 10-20 percent, and in the poultry sector 20-30 percent. Those protein needs are partly supplied by cereals. However, protein meal is a proportionally more expensive ingredient than feed grains and wheat.

In terms of value, meal feeding is only prominent in the poultry sector. But feeding variation exists within the chicken ration categories.

Corn and meal are complementary feed ingredients. Substitution of one for the other is very limited. Corn is mainly an energy provider with relatively low protein content (9-10 percent), whereas meal generally has a protein content of 35-50 percent. Wheat can replace corn and to a certain extent meal as wheat has a higher protein content (12-14 percent). Wheat as a protein provider is used extensively in the U.S.S.R. and in Eastern and Western Europe. (Barley is usually not used in poultry rations; its energy content tends to be too low and its fiber too high.) However, large quantities of wheat are needed to substitute for meal in rations. This makes it a rather poor competitor for meal, particularly if wheat prices are relatively high. On the other hand, meal can be used for energy requirements if its price is very low. There is somewhat more flexibility in protein requirements than in energy requirements.

Poultry

About 50 percent of the world's meal supply is absorbed by poultry (mainly chickens). Poultry are accepted and produced around the globe. They are a more efficient feed user than cattle and hogs. The importance of poultry as a meat supply will likely increase (as it has already in Western Europe and dramatically so in Japan). Although poultry production has a shorter cycle than cattle and hog production, it has been quite volatile during its past 20 years of growth.

Hogs

Hogs, whose energy requirements are also more rigid than their protein requirements, consume about 30 percent of the world's meal supplies. Protein requirements in swine rations average 15 percent. This can only be partially supplied by corn (with its 9-percent protein

TABLE 3. CHICKEN STARTER RATIONS

Ingredient	Rations 1	2	3	4	5	6
	pounds per ton					
Corn	1,320	–	700	1,425	–	750
Wheat	–	1,480	700	–	1,595	750
Meal	580	420	500	475	305	400
Other[a]	100	100	100	100	100	100
Total	2,000	2,000	2,000	2,000	2,000	2,000
(Crude Protein, %)	(20.2)	(20.1)	(20.1)	(18.0)	(18.0)	(18.1)
(Metabol Energy, Kcal/lb)	(1,368)	(1,337)	(1,354)	(1,386)	(1,352)	(1,369)

[a]Fat – 20 lb, ground limestone – 25 lb, calcium phosphate – 30 lb, salt – 5 lb, vitamins – 20 lb.

Source: *1972 Poultry Feed Formulas,* Ontario Ministry of Agriculture and Food, Toronto.

TABLE 4. CHICKEN BROILER FINISHER RATIONS

Ingredient	Rations 1	2	3	4	5	6
	pounds per ton					
Corn	1,195	–	630	1,257	–	660
Wheat	–	1,330	630	–	1,405	660
Meal	615	475	550	515	365	450
Other	200	195	190	228	230	230
Total	2,000	2,000	2,000	2,000	2,000	2,000
(Crude Protein, %)	(20.5)	(20.5)	(20.6)	(20.5)	(20.5)	(20.6)
(Metabol Energy, Kcal/lb)	(1,450)	(1,427)	(1,437)	(1,451)	(1,425)	(1,439)

Source: *1972 Poultry Feed Formulas,* Ontario Ministry of Agriculture and Food, Toronto.

content) and wheat (13-percent protein content). Barley, which is prominent in Western Canada and Quebec, and which has a protein content of about 11 percent, can also be used.

Cattle

Protein requirements for dairy cattle are generally less than 10 percent of total dry feed when the animal's weight surpasses 150 kg; for beef cattle, protein requirements are generally 8-13 percent. Meal use in cattle feeding is therefore small, compared with the number of cattle. Feeding requirements can largely be met by coarse grains and wheat. Ruminants have a different digestive system from that of hogs and poultry (monogastrics), allowing for more feeding flexibility. (At least 33 percent of their protein requirements can be met by urea, a petroleum based protein source.) Cattle feeding accounts for about 20 percent of meal disappearance in North America but much less in Europe and Japan.

Hence meal is a relatively expensive feed ingredient which plays a dominant role only in poultry feed rations. (On August 31, 1979, in the Chicago market, the price of soybean meal, September delivery, was 1.87 times that of corn.) In hog and cattle rations it is a less important but still relatively expensive supplement.

Meal Substitution

Meal is less essential for animal survival than the energy providing feed grains. (Poultry consume only enough feed each day to meet their energy requirements.) Protein content and physical growth rate can be varied without serious physical ill effects – poultry after a considerable lag, hogs more readily. If warranted by economic conditions, meal can be eliminated to some extent from livestock rations, particularly where livestock feeding is less sophisticated. However, the existing meal substitutes – wheat, alfalfa, corn gluten, blood meal, and dry milk – are of lower quality, have a lower protein content, are often not available in sufficient quantities, and sometimes cannot be used for all livestock categories.

Substitution can normally only be carried out with a time lag. Therefore, the demand for meal tends to be inelastic in the medium-price range. This could change with the development of new feed grain varieties which are rich in protein.

Profitability of Livestock Feeding and the Use and Price of Meal

If livestock feeding is profitable, meal can be used profitably. Since meal is not easy to replace and the costs are often modest because of the small quantities involved (notwithstanding high prices per unit), meal demand tends to be inelastic. If meal is in short supply and complementary feed ingredients are not a restricting factor, prices might rise to great heights before demand decreases significantly. If meal supply is ample there is no immediate outlet for excess supply, except to replace feed grains as an energy source if meal prices are very low. Since meal is only a feed supplement, poultry and livestock numbers and supplies and prices of other complementary feed ingredients limit its use. Often the meal price has to decrease substantially before use will increase sufficiently to reduce excess stocks.

If there is a profit squeeze or if livestock feeding is unprofitable, meal use also tends to be unprofitable. Since meal is often unessential and has a relatively high price per unit, there is a tendency to reduce its use in rations

TABLE 5. PROTEIN AND ENERGY REQUIREMENTS

Ration	Protein	Energy
	%	Kcal/lb
Free Choice Chicken Grower	11 – 14	1,264 – 1,423
Restricted Chicken Grower	16.4 – 16.7	1,233 – 1,386
Laying Rations	15.0 – 17.0	1,258 – 1,309
Chicken Broiler Starter	20.5 – 24.3	1,379 – 1,450
Chicken Broiler Finisher	20.5 – 20.6	1,427 – 1,451

Source: *1972 Poultry Feed Formulas,* Ontario Ministry of Agriculture and Food, Toronto.

without necessarily replacing it if livestock feeding is unprofitable. In addition, poultry and hog numbers can be decreased rather rapidly, notwithstanding the rigidities of increasing large scale production. As a result, meal use or demand may decrease rapidly and prices might fall to where meal may become a substitute for feed grains. (In other words the change of the profitability of livestock feeding from positive to negative will generally cause the demand curve to shift to the left. As a result of hard economic facts, feeder mentality tends to change from "growth" to "survival.")

The feeder tends to lose interest, to a degree, both in growth per animal and in growth of livestock numbers. The value of the marginal productivity of the growth agent (meal) decreases more than for the life-sustaining feed grains. At constant prices, meal use per animal tends to decrease more than feed grain use per animal, and more immediately for hogs and cattle than for poultry. Composition of poultry rations is more rigid in the short run.

Furthermore, a change in livestock profitability will result in a decrease in livestock numbers. Hog and poultry numbers can be reduced faster than cattle numbers. Compared with cattle, hogs and poultry consume proportionally more meal than feed grains. Hence meal use will be reduced faster than feed grain use. Because of a profit squeeze the demand curve for meal will shift faster and further to the left than feed grain demand. Consequently, meal prices tend to decrease faster and lower than feed grain prices.

If the profit squeeze is due to increasing feed costs rather than decreasing meat prices (or milk or egg prices), a substitution effect might occur which could slow the parallel displacement of the meal demand curve to the left. If feed grain prices increase significantly, relative to meal prices, meal might substitute for feed grains (for energy purposes).

If there is a profit squeeze, not only will there be a shift of the meal demand curve to the left, but the shape of the meal demand curve will probably also become more curvilinear. Livestock feeders' demand for meal will become more sensitive to meal price levels, and inferior substitutes more attractive, particularly if meal prices are high. The elasticity of meal demand increases in the higher price ranges.

Because of the possibility of relatively cheap meal to replace feed grains for energy, meal demand will be rather elastic in the lower price ranges (depending on the elasticity of substitution). In recent years the supply curve for meal has also become more elastic at low prices because of the increasing capacity of farmers, particularly in North America, to hold stocks. They can choose not to sell below cost price.

If both the demand and the supply curves of meal tend to be elastic at the lower price levels, there will be a tendency of the meal price not to decrease below certain minimum (cost) price levels. For example, from early 1975 until May 1976, soybean meal prices in Chicago did not decrease below U.S. $120 a ton, although the 1975 recession was the worst since World War II. In addition, the U.S. soybean crop in 1975 was a record, as was the Brazilian soybean crop early in 1976. More recently (1979), meal prices have not declined below U.S. $180, notwithstanding recurring recession, a profit squeeze in the hog and poultry industries, and a threatening meal surplus.

TABLE 6. NUTRIENT REQUIREMENTS OF SWINE FED AD LIBITUM

	Live Weight (Kg)					Breeding Swine, General
Nutrient	5 - 10	10 - 20	20 - 35	35 - 60	60 - 100	
Metab Energy (Kcal/Kg)	3,360	3,360	3,170	3,170	3,170	3,170
Crude Protein (%)	22	18	16	14	13	14

Source: *Nutrient Requirements of Swine, 1973,* National Research Council, Washington.

The connection between meal use and meal prices on one hand and the profitability of livestock feeding on the other, is logical but cannot be easily substantiated. Meal prices, as depicted in the section on historical price behavior, are not related to the profitability of livestock feeding alone – they are a result of all supply and demand factors.

In this context some general observations can be made on the specific relations between meal prices and the profitability of livestock feeding (Table 7). During 1975, cereal and meal prices were low and decreasing. Livestock feeding tended to be unprofitable during the first half of the year and profitable only from May until October 1975.

Livestock feeding was generally unprofitable in 1976, but less so for poultry and hogs than for cattle. Cereal prices decreased, but meal prices, instead of declining, increased because of a drop in oilseed plantings in North America.

Feeding margins in 1977 tended to be small or negative for all livestock and poultry. During mid-year, soybean meal prices decreased and soybean crushings in the United States and Western European meal imports were each down 25 percent, compared with year-earlier levels. Cereal prices were also at low levels.

Profitability during 1978 was high for livestock and poultry feeding. Hog and poultry numbers increased strongly in the United States and in Western Europe. In Western Europe, meal was successfully combined, among other things, with cheap protein-poor casava which replaced feed grains. Although meal and feed grain supplies were at record levels, prices tended to increase; however, in North America the declining exchange rates also had a price increasing effect.

The evidence presented, although not conclusive, seems to support a positive relationship between the profitability of livestock feeding and meal prices.

The Profitability of Livestock Feeding

A proper analysis of the profitability of livestock feeding itself is beyond the scope of this article. However, the topic deserves further scrutiny here since it is probably a key determinant in meal pricing.

The profitability of livestock feeding depends on prices of meat and meat products on one hand and costs of feed and other inputs on the other. Meat prices are dependent on the supply of livestock for slaughter (and as a result the supply of meat products) on one hand and the demand for meat products on the other.

Livestock available for slaughter depends very much on the different phases of the livestock cycles. Cattle have a longer cycle than hogs and hogs have a longer cycle than poultry. Poultry numbers can be adapted more quickly. The cyclicality of livestock production, based on anticipation and slow adjustments, has a strong price disturbing effect. Of course livestock prices are not only a result of livestock supply, but are also affected by the demand for meat and meat products. Demand for livestock products is not the same in different parts of the world, as it depends on habits and living standards. Livestock products are highly desired but high-priced consumer goods. Therefore meat consumption is largely confined to the developed world. Changes in real per capita income tend to have an effect on meat demand and therefore meat prices. The unstable economic conditions peculiar to the developed world have, through the demand for and prices and profitability of meat and meat products, an unstabilizing effect on world demand and therefore on world prices of meal.

OUTLOOK

The scope for an increase in world meal production seems limited. Production increases in the Northern Hemisphere are virtually dependent on the spread of new varieties of oilseeds, particularly soybeans, which require less heat units and can be grown in marginal areas. Continued U.S. expansion of U.S. soybean production would be mainly at the expense of cereals, particularly corn. However, corn production could regain ground if feed grain prices rise.

The EEC and the Soviet Union have limited potential for meal production because of their large cereal demands. Land resources are limited in Europe and any new areas of production in the U.S.S.R. are likely to be marginal. Although a large demand exists in both regions, meal production has been small. Chinese meal production is not large and thus far not dynamic. The needs of the large Chinese population will preclude any export availabilities in the long run. The potential for a meal production increase in the Southern Hemisphere is more promising but not exceptional. Additional land resources in South America appear to be either limited (in Argentina) or marginal (in Brazil). Planting increases in Brazil have been modest during the last few years. Any increase of meal production for export in South East Asia is probably remote. It seems limited to copra meal and palm-kernel meal which are not produced in large volumes. The potential in South

TABLE 7. MEAL PRICES AND THE PROFITABILITY OF LIVESTOCK FEEDING

Year	Quarter	Average Net Margins		Meal Prices
		Hogs	Broilers	
		$ a cwt		$ a ton
1976	1st	−3.84	+4.70	143
	2nd	+2.00	+3.70	172
	3rd	−4.74	+0.10	237
	4th	−9.83	−5.00	201
1977	1st	+2.30	+0.10	237
	2nd	+1.65	−1.10	279
	3rd	−3.06	+1.00	164
	4th	−2.51	+1.60	168
1978	1st	+8.39	+3.10	179
	2nd	+6.06	+7.50	192
	3rd	−3.17	+5.70	183
	4th		+2.70	199
1979	1st	—	+6.40	190

Sources: *Livestock and Meat Situation, Poultry and Egg Situation,* and *Fats and Oils Situation,* USDA, Washington.

Africa and Australia is uncertain. No large export supplies are expected from these areas in the medium term.

World meal demand will probably increase only if world living standards increase significantly and world cereal prices remain relatively low. World living standards are not expected to increase strongly in the near term, partly because of high fuel oil prices. This, among other things, will limit the growth of meat demand and prices.

World growing conditions for cereals and oilseeds have been favorable for four consecutive years, keeping world cereal production more than abreast of world demand. Any shortage will increase cereal prices and the cost of livestock feeding. Hence the profitability of livestock feeding and therefore meal demand might be negatively affected.

Consequently, no great increase in meal production and use is foreseen in the medium term. And no great structural discrepancy between supply and demand increase is expected, though in a shorter term, demand and supply will vary because of the reasons stated above. Prices are expected to continue to behave erratically in the medium price range. The moderating influence of increasing South American soybean production will probably be somewhat offset by the speculative effect of growing potential and volatile demand from the U.S.S.R. and Eastern Europe. However, meal prices are increasingly unlikely to drop below cost price. If the profitability of livestock feeding remains small because of sluggish world economic conditions expected in the medium term, meal prices will be less likely to repeat the sharp increase of 1973 and 1977.

Canadian meal production (meal basis) is expected to grow in volume and even more in value. Canadian meal prices will continue to stay in line with world market prices. During the next five years Canadian meal prices might fluctuate within a narrower price range.

SUMMARY AND CONCLUSIONS

Since 1971, price behavior of high protein meal has been particularly erratic, more than that of cereals with which it is combined in livestock feeding. Destabilizing price factors exist both on the supply and the demand side of meal. The production and trade situation is more clear-cut and easy to analyze than demand. There is a remarkable concentration of meal production and exports in the United States and of imports in the EEC and Japan, although production is increasing in South America and imports increasing in Eastern Europe.

The nature of the demand for meal is more complex than that of supply. The demand for meal from the final consumer of meat products is indirect.

Meal is generally used as a relatively expensive supplement in modern livestock and poultry feeding. Its use in livestock feeding appears to be less essential than that of feed grains. Meal use is usually dependent on the profitability of feeding and on livestock and poultry

numbers. Analysis of numbers and profitability is largely beyond the scope of this article; however, livestock and poultry numbers depend very much on the phases of the livestock and poultry cycles. The profitability of feeding depends on input costs (mainly feed grain and meal supplement costs) on one hand, and meat prices on the other. Meat prices in turn depend on the supply and demand for meat. In most areas the demand for meat is sensitive to consumer disposable income which is connected to the state of the world economy. All factors mentioned tend to make supply and demand and therefore prices rather volatile. However, in recent years meal prices have shown a tendency not to decrease below cost price. Furthermore, expected sluggish economic conditions might prevent extreme price increases in the medium term.

This article has been an initial survey of factors and relationships responsible for meal price behavior. The relative weight of the supply and demand factors mentioned has not been indicated; this requires further research. In fact, it requires continuous scrutiny to increase, to correct, and to refine the store of analytical knowledge and comprehension necessary for successful forecasting. At this stage, production factors, particularly plantings and yields of the U.S. soybean crop, are most obvious and have a more immediate short-term price effect. The more elusive demand factors are more difficult to define and predict. Information is more difficult to obtain and requires knowledge of related disciplines. Demand factors have a more gradual price effect.

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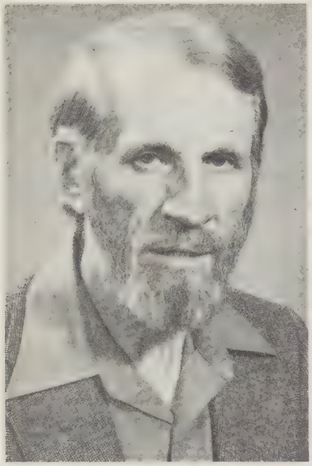
LOW INCOME FARM FAMILIES IN 1976



Low income farm families in 1976 were found in significant proportions and numbers in all provinces. Their income levels were considerably below the average low income cutoff for all families. To combat this social problem, a mixture of programs such as stabilization, income support, resource transfer or adjustment programs, and resource development programs should be implemented.

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INTRODUCTION

Information on the welfare of farm families is needed to be more precise about the current status of low income farm families – including their number, location, and how they are distributed according to various criteria. Such information also helps in formulating programs to combat low farm incomes and to assess their operation and effectiveness.

Traditionally, studies on farmers' welfare have emphasized the incomes which farmers receive from the farm operations and have given little attention to the income farm families receive from off-farm sources. The 1958 Farm Expenditure Survey (5) drew attention to the relative size and importance of off-farm income. Subsequently, as data on farm and off-farm income became available from taxfiler records, the Consumer Finance Survey, the 1971 Census of Agriculture and Population Linkage Program, and from special studies, publications began to appear (1, 4, 7, 8) which examined provincial and national farm welfare in terms of farmers' monetary income from all sources. This article analyzes the welfare of farmers in terms of their total monetary income. The primary objective is to take a close look at the level and distribution of incomes and the consequent policy implications for farmers who are classed as having low or inadequate total incomes.

This study is also methodological as it applies and adapts new data sources, classifications, and concepts. Hence the conclusions from the analysis should be considered tentative and subject to further study, testing, and review.

Farm taxfiler data, which are the sources for statistics on farm and off-farm income of farmers, are still relatively new and developmental, and do not reconcile well with other income series. The study applies a modification of a system proposed by Shultz (9) to classify farm taxfilers into categories which are more homogeneous than unclassified records and can be considered as approximations to full- and part-time farmers. In addition, the study develops a method of classifying farm taxfilers by family size based on family allowance data from the same tax records. By applying Statistics Canada's low income cut-offs (appendix) to these family sizes, it becomes possible to classify, with reservations, part- and full-time farmers into those with low (or inadequate) and adequate total income.

A more detailed description of the nature of farm taxfiler data, the procedures for classifying the data, the adaptations and simplifying assumptions resorted to, and areas of weakness in the methodology is in the appendix.

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TABLE 1. NUMBERS OF FARM TAXFILER FAMILIES, BY DEPENDANCE ON FARMING, WITH LOW (INADEQUATE) INCOMES, CANADA AND THE PROVINCES, 1976

Area	Full-Time Farm Families			Part-Time Farm Families			All Farm Families[b]		
	Low Income	Total	Low as Percentage of Total	Low Income	Total	Low as Percentage of Total	Low Income	Total	Low as Percentage Of Total
	— number —		— % —	— number —		— % —	— number —		— % —
Canada[a]	80,260	223,880	35.8	34,880	182,720	19.1	115,155	406,605	28.3
Newfoundland	160	265	60.4	80	285	28.1	245	550	44.5
Prince Edward Island	960	1,845	52.0	465	1,370	33.9	1,420	3,220	44.1
Nova Scotia	975	1,965	49.6	705	3,065	23.0	1,680	5,030	33.3
New Brunswick	890	1,675	53.1	535	2,115	25.3	1,425	3,790	37.6
Atlantic Provinces	2,985	5,755	51.9	1,785	6,830	26.1	4,770	12,590	37.9
Quebec	10,555	25,325	41.7	3,375	16,705	20.2	13,925	42,035	33.1
Ontario	19,260	51,225	37.6	9,295	56,410	16.5	28,560	107,640	26.5
Manitoba	10,845	24,860	43.6	4,580	17,215	26.6	15,415	42,075	36.6
Saskatchewan	16,290	65,570	24.8	5,595	28,380	19.7	21,885	93,945	23.3
Alberta	16,940	43,610	38.9	7,840	41,420	18.9	24,775	85,030	29.1
Prairie Provinces	44,070	134,035	32.9	18,005	87,015	20.7	62,075	221,050	28.1
British Columbia	3,165	7,120	44.5	2,400	15,565	15.4	5,565	22,690	24.5

[a] Includes data for Yukon, Northwest Territories, and non-resident taxfilers.
[b] Figures may not add because of random rounding to maintain confidentiality.

INCIDENCE OF LOW INCOMES

Of the 406,605 farm taxfilers in 1976 (Table 1), 115,155 (28.3 percent) represent farm families with low or inadequate incomes as determined by the application of the low income cutoffs. The low income category includes full-time farmers (farm income forms in absolute terms 50 percent or more of total income) and part-time farmers (farm income forms in absolute terms less than 50 percent of total income).[1]

Of the 223,880 farm taxfilers classed as representing full-time farm families, 80,266 (35.8 percent) were identified as having low or inadequate incomes in 1976. Regionally, the incidence was highest in the Atlantic Provinces (where 51.9 percent of farm families had low incomes) followed by British Columbia, Quebec, Ontario, and the Prairie Provinces. The incidence in the latter was 32.9 percent. The 34,880 part-time, low income farm families formed 19.1 percent of all part-time farm families, substantially less than the 35.8 percent for their full-time counterparts. The regional ranking was also different. The incidence of low incomes in the Prairie Provinces at 20.7 percent was second highest to that in the Atlantic Provinces.

The percentage of low income farm families is only one aspect of incidence. Another is the total number of farm families with low incomes. This aspect of incidence reflects the size of the farm sector and is useful in inter-regional and inter-provincial comparisons to indicate the magnitude of the low income problem and, in policy formulation, to indicate to governments the cost of rural development and adjustment programs to combat low incomes. Further, the relative magnitudes of the farm compared with the non-farm sectors of the provincial economies may indicate the financial ability of the provinces, though not necessarily their willingness, to implement such programs in the farm sector.

Over half (44,070) of the 80,260 full-time, low income farm families were in the Prairie Provinces, a reflection of the importance of the farm sector to the region and to Canadian agriculture. Of the remaining low income families, 19,260 were in Ontario, followed in declining order of farm family numbers by Quebec, British Columbia, and the Atlantic Provinces. This is the reverse of the ranking on the basis of percentages. For part-time, low income farm families, the regional and provincial ranking based on numbers is the same as for their full-time counterparts.

The general conclusion that can be made from the analysis of Table 1 is that low income farm families in 1976 were widely distributed throughout Canada and were found in significant proportions and numbers in all provinces. This conclusion is similar to that reached in a study for 1974 (4, p. 20), although the low income classifications are not exactly the same.

[1] For a more detailed discussion on the classification of full- and part-time farmers see "Degree of Dependence on Farming" in the appendix.

INCOME SOURCES

Income sources are important in studying the welfare of low income farm families (Table 2) because they can indicate the reasons for low incomes. For full-time farmers two features of income sources stand out. One is that farm income, negative in some provinces, is, along with other income (mainly transfer payments), one of the two major sources of revenue. The other is that wages and salaries, after allowance for provincial variation, are a small component of total net income, being of the same magnitude as income from family allowances and investments.

The low level of wages and salaries suggests that they arise from taxfilers' casual employment, such as seasonal off-farm work or local short-term jobs. Another reason for the low level is that only 49 percent of all full-time farmers reported earnings from off-farm work (11).

A major feature of part-time farmers' income sources is that average farm income was negative in 1976.

TABLE 2. NET INCOME OF FULL-TIME AND PART-TIME FARM TAXFILER FAMILIES WITH LOW (INADEQUATE) INCOMES, CANADA AND PROVINCES, 1976

Farm Families	Net[a] Farm	Net Off-Farm Self Employment	Wages and Salaries	Investment[b]	Family Allowances	Other[d]	Total
				dollars			
Full-Time							
Canada[c]	362	24	267	272	244	397	1,566
Newfoundland	1,467	−12	172	134	272	619	2,652
Prince Edward Island	433	26	286	162	199	433	1,539
Nova Scotia	332	13	242	308	195	747	1,837
New Brunswick	325	−13	296	216	238	642	1,704
Quebec	2,566	9	207	209	364	355	3,710
Ontario	−588	29	286	339	200	494	760
Manitoba	914	16	192	188	229	329	1,858
Saskatchewan	1,168	16	200	172	244	281	2,081
Alberta	−528	36	343	329	248	378	806
British Columbia	−2,448	70	564	617	181	699	−317
Part-Time							
Canada[c]	−1,211	373	2,380	758	221	543	3,064
Newfoundland	−588	508	2,215	276	308	932	3,651
Prince Edward Island	−1,057	512	2,190	512	229	829	3,215
Nova Scotia	−1,186	511	2,400	648	245	790	3,408
New Brunswick	−1,258	453	2,699	577	250	830	3,551
Quebec	−549	157	2,081	780	303	828	3,600
Ontario	−1,260	432	1,936	1,040	180	604	2,932
Manitoba	−1,108	391	2,476	561	218	485	3,023
Saskatchewan	−695	246	2,151	553	207	457	2,919
Alberta	−1,610	436	3,042	609	247	379	3,103
British Columbia	−2,101	426	2,692	1,126	204	545	2,892
All Farm Families							
Canada[c]	−115	130	907	419	237	441	2,019
Newfoundland	772	158	847	182	283	721	2,963
Prince Edward Island	−61	184	906	276	209	562	2,076
Nova Scotia	−303	223	1,150	450	216	766	2,502
New Brunswick	−271	162	1,198	353	242	713	2,397
Quebec	1,812	45	660	347	349	469	3,682
Ontario	−786	160	823	567	193	530	1,487
Manitoba	314	127	869	298	226	375	2,209
Saskatchewan	691	75	699	270	234	326	2,295
Alberta	−870	163	1,196	417	248	378	1,532
British Columbia	−2,302	224	1,482	836	190	633	1,063

[a] Figures in column one may be less than 50 percent of those in column seven because of the inclusion of negative net farm incomes.
[b] Includes rental income.
[c] Includes data for Yukon, Northwest Territories, and non-resident taxfilers.
[d] Includes pensions, U.I.C. benefits, etc.

Another major feature is that wages and salaries were by far the largest contributor to total income. This suggests that their earnings are from more substantive employment than for full-time farmers. It also indicates that a larger proportion are working, as nearly 80 percent of part-time farm taxfilers reported earnings from off-farm work (11).

Comparing the two groups, total income of part-time farmers, although inadequate, is about twice as high as that for their full-time counterparts. Also, part- and full-time farm taxfilers are classified to the low income category for basically different reasons – full-time farm taxfilers because their farm incomes are low, and their part-time counterparts because their wages and salaries are low.

The general conclusion which emerges from Table 2 is that there is wide disparity between the income levels of farm families with inadequate income and the low income cutoff. The levels of total incomes of part- and full-time farmers at $1,566 and $3,064 nationally, are considerably below the average[2] low income cutoff for all families of $5,072 or more in 1976 (11). This disparity can be attributed to farm families with negative incomes in both categories (11) which pull down the farm and total incomes of full-time farm taxfilers and contribute to the consistently negative farm incomes of their part-time counterparts.[3] The large number of farm taxfiler families with negative or small positive incomes also implies inefficient use of farm resources. This appears to be more prevalent on part-time[4] than on full-time farms (11). Combined with the conclusion from Table 1 that low income farm families are present in important magnitudes in all provinces, this study suggests that poverty, and the accompanying inefficient use of farm resources, is a significant social problem in Canada.

A further implication is that farm poverty can spill over and affect the welfare of non-farm families in communities dependent on the farm sector. The incomes of farm input dealers, merchants, and local professionals might be lowered, the quality of their services reduced, and the amenities provided by the communities cut back.

[2]Weighted by numbers in each family size.

[3]There were 21,870 full-time and 23,065 part-time farmers with negative incomes in the low income classifications.

[4]Of the 34,890 low income, part-time farmers, 66.1 percent had negative and 28.5 percent small but positive ($0 to $1,249) net farm incomes. The corresponding figures for low income, full-time farmers were 27.2 and 15.3 percent.

POLICY IMPLICATIONS

As indicated, low incomes in the farm sector can lead to reduced family welfare and inefficient farm resource use. Following are four suggested policies to combat low incomes among farm families: 1. stabilization measures, 2. income support measures, 3. resource transfer or adjustment programs to remove excess resources out of farming and into other occupations, and 4. resource development programs to upgrade farm labor and capital resources.

Stabilization

Stabilization programs are largely ineffective in assisting low income farm families. Payments under these programs are made on the basis of units of a commodity sold and since low income farmers tend to have a low volume of sales, stabilization could not increase their incomes appreciably unless the price support level was substantially above market levels. Stabilization has a place, however, in an overall package of farm programs, as greater stability of the farm income flow is desirable for low as well as for adequate income farmers.

Income Support

Income support programs, which would make payments to low income families, such as through a negative income tax scheme to raise incomes to acceptable levels, are largely inappropriate on an extensive scale. This is because of the high costs that would be involved, as suggested by the conclusions from Table 2, and because of the long-run debilitating effects they would have on the incentives and morale of the recipients. There is room, however, for a limited application of income support programs for farmers near retirement or in ill health, or as temporary measures to tide over low income farmers while longer-term farm resource development or resource transfer programs are being implemented. In such cases, the judicious and temporary use of income support programs could ease the adoption and the effective operation of the longer-term programs.

Resource Transfer

Resource transfer programs facilitate the "push" and "pull" forces, which are always present in the economy, to transfer resources from a lower to a higher paying occupation, easing the adjustment burden for farm families who decide to relocate. Such programs would provide early retirement, retraining for a new occupation, and financial means for governments to buy the

farm assets at fair prices, ensuring their quick release from present uses and reabsorption into the commercial part of the farm sector. Resource transfer programs are most effective if they are restricted to farmers unsuited to remain in farming.

Resource Development

Resource development programs are also effective if they are selective and confined to farmers with the potential to develop viable farm units. Programs facilitating such development would upgrade farmers' management skills and provide incentives and grants to encourage them to increase their farm sizes and to adopt improved farm practices and technology.

Summary

No one program alone but a mixture of programs, operating over an extended period, are needed if the number of low income farm families is to be reduced permanently. Farm resource transfer and development programs would be the basic components of such a mixture, but they should be complemented by stabilization, market development, and temporary income support programs, and by programs aimed at maintaining high employment in the economy.

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APPENDIX: METHODOLOGICAL CONSIDERATIONS

This appendix provides definitions, documents procedures, indicates weaknesses in the data and classifications, and suggests areas for further development or improvement. This should help place the conclusions and methodology in proper perspective.

Tax Records as a Data Source

Although tax data have been under development for some years, they do not reconcile well in terms of level with other farm income series. The reasons for this are not entirely clear; those that are known pertain to the administrative nature of the records whose main purpose is to collect taxes and not to report farm income data. Conceptual differences (i.e., no value of inventory change, and the use of capital cost allowances instead of depreciation) cause some incomparabilities. Incomplete coverage due to the exclusion of incorporated farms, which report under a different section of the income tax act, causes taxfiler data to be below the level of Statistics Canada's aggregate net farm income series. Also, farm tax regulations allow tax reduction strategies by taxfilers and affect the income levels reported.

The number of taxfilers, nationally and in most provinces, is higher than the number of census farms, even though the definition of a census holding (one acre in size and $50 of sales) is fairly similar to the definition of a farm taxfiler–one who reports some farm income on his tax record.[1] Prudence in the use of taxfiler data calls for a reliance on percentage changes, ratios and income averages per taxfiler rather than on aggregate income levels and on actual numbers of farm taxfilers.

Degree of Dependence on Farming

To achieve greater homogeneity of the data and to make them more amenable to analysis and policy proposals, farm taxfilers are classified by a scheme proposed by Shultz (9) according to those with a major dependence on farming when net farm income is more than 50 percent of net income from all sources, and those with minor dependence on farming when net farm income forms 50 percent or less of net income from all sources. The formula[2] to achieve this classification of farm taxfilers excludes transfer payments from total net income on the grounds that they are not earned and are available to the farm family regardless of occupation. The formula is in absolute terms to permit the classification of farmers with negative farm incomes. The logic underlying the use of absolute values is that a dollar of negative farm income is as important as a dollar of positive farm income in indicating a farmers' dependence on farming. It is useful to identify farm taxfilers with negative and small positive farm incomes as they may be indicative of inefficiency in farm resource use.

The classification is considered to provide approximations of full- and part-time farms if it is realized that full-time farmers may still earn considerable off-farm income and that part-time farmers remain a fairly heterogeneous group with a variety of motives for taking up farming operations.

Low Income Cutoffs

The low income cutoffs developed by Statistics Canada are based on the 1969 Family Expenditure Survey. The cutoffs establish income levels below which farm families are considered to be in "straitened" circumstances, i.e., have low or inadequate incomes. The level was determined partly from the survey and partly by judgement as being at a point where families spent at least 62 percent of their monetary income on the basic necessities of food, clothing, and shelter (10); the remaining 38 percent is discretionary income, which the family may spend at its discretion on other items. Actual family incomes may be below cutoff levels and might range from families where discretionary income is present but reduced, to families where incomes are insufficient for basic needs. The cutoffs are updated annually by the Consumer Price Index so that they depict families as buying the same "package" of goods as consumer prices rise. In 1976 the cutoffs were $2,992, $4,341, $5,537, $6,584, $7,363, $8,080, and $8,859 for farm families of one to seven and more members, respectively.

The cutoffs have two questionable areas in measuring the adequacy of farm family incomes. First, they are based on monetary income and do not include a value for income-in-kind (home grown food and use of the farm house), an important contributor to farm family welfare. Low income cutoffs for farm families were set at 80 percent of the standard urban cutoffs (cities of 30,000 to 100,000) to allow for the lower expenditures of farm families for food and housing. It is not clear without further study, however, whether this is a sufficient allowance and if it would give the same incidences of low income cutoffs with a properly valued amount for income-in-kind included.

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[1] For a more detailed discussion see Darcovich, W., *et al* (2).

[2] The formula is $|FI| / (|FI| + |NFI|) \geqslant 50\%$ where FI is farm net income and NFI is off-farm income exclusive of transfer payments; the latter comprises family allowance and "other" income as in Table 2.

Second, low income cutoffs are on a fixed standard-of-living basis. If the average level of living rises in the long-term, fixed cutoffs would tend to show a declining number of low income families. Since this is the eighth year that a fixed living standard is being maintained in the cutoffs through indexing for inflation, the results in Table 1 may appreciably underestimate the incidences and the number of low income farm families when measured according to a current standard of living. This could create a false impression of the extent of agricultural adjustment that has taken place, the extent of income maintenance required, and the effectiveness of agricultural adjustment and development programs.

Farm Taxfiler Families

Tax records provide data on the income of farm taxfilers, indicate those with a spouse, and show family allowance payments from which the number of dependents is determined. With this information it has been possible to classify farm taxfilers by family size, from one to six or more family members, and to determine which families have inadequate incomes by applying the low income cutoffs to the farm taxfilers' total income. The total income of the taxfiler is the same as the total income of the family in cases where other family members earn no income. The income of the taxfiler and of the family are somewhat less well matched, but still acceptably so for families in which the earnings of other family members are not high enough to file a separate tax return. There is evidence (4, p.43) that these two cases form about 57 percent of all farm families. The inference is that for this major group of families the low income cutoffs perform satisfactorily in classifying them for income adequacy.

When family members other than the taxfiler begin to earn taxable income and become taxfilers themselves, several things may happen which can lead to unclear consequences on taxfiler statistics. As family members become taxfilers, family "splitting" arises and family size and income which the taxfilers represent become smaller than they otherwise would be and the distribution of families by size changes (4, p.44). It then becomes uncertain how well the low income cutoffs classify the remaining 43 percent of the farm taxfiler families for income adequacy. Elimination of this uncertainty will require basic changes in the classification of farm taxfilers by family size; families split by having more than one member with taxable income would have to be reunited and their incomes aggregated by computer linkage procedures, and wholly dependent children would need to be reported directly from tax forms rather than by relying on family allowance payments.

ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE

Item	Units or Base	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual	1979 I	1979 II
Production and Income											
1. GNP at Market Prices[a]	$ mil.	211,504[b]	216,824[b]	209,379[b]	221,428[b]	228,052[b]	233,600[b]	238,548[b]	230,407[b]	247,640	253,800[c]
2. Farm Cash Receipts Total[d]	$ mil.	2,624.3	2,664.8	10,114.6[b]	2,992.6[b]	2,648.8[b]	2,954.7[c]	3,323.1[c]	11,810.1[b]	3,444.4[b]	3,351.9
3. – Total Crops[d]	$ mil.	1,107.5	1,140.0	4,360.2[b]	1,470.7[b]	1,010.5[b]	1,148.6[c]	1,312.3[c]	4,912.1[b]	1,449.7[b]	1,176.6
4. – Total Livestock[d]	$ mil.	1,393.4	1,401.1	5,254.7[b]	1,419.1[b]	1,547.7[b]	1,711.2[c]	1,894.3[c]	6,515.4[b]	1,917.2[b]	2,052.8
5. Net Income Rec'd by Farm Operators[a]	$ mil.	2,828.0[b]	2,712.0[b]	2,874.0[b]	3,020.0[b]	4,152.0[b]	3,252.0[b]	3,632.0[b]	3,514.0[b]	3,772.0[b]	4,212.0
Trade											
6. Agricultural Exports	$ mil.	1,120.0	1,088.9	4,264.9	946.4	1,230.5	1,261.4	1,390.1[c]	4,828.0[c]	1,204.4	1,354.7
7. Agricultural Imports	$ mil.	827.5	880.9	3,555.8	876.6	1,088.5	943.2	1,104.4[c]	4,012.7[c]	1,129.2	1.181.6
8. Real Domestic Product, Ag[a]	1971=100	N.A.[f]	114.0[b]	108.8[b]	119.5[b]	114.3[b]	117.5[b]	119.7[b]	117.8[b]	120.4[b]	119.8
9. Real Dom. Prod., Less Ag[a]	1971=100	130.2	131.1	130.0	132.0	133.4[b]	134.4[b]	136.7	134.2	139.1	138.7
Price Indexes											
10. Farm Input Price Index	1971=100	181.3	181.7	180.0	190.8	200.2	203.2	209.2	200.9	224.0	228.4
11. – Buildings and Fencing	1971=100	186.7	190.0	183.9	193.5	197.6	203.1	209.9	201.0	216.1	223.2
12. – Machinery & Motor Veh.	1971=100	165.0	169.1	166.4	172.6	174.0	176.0	182.1	176.1	188.0	191.3
13. – Crop Production	1971=100	215.2	216.1	213.7	217.9	225.5	228.3	230.2	225.5	238.6	252.0
14. – Animal Production	1971=100	169.3	165.2	167.4	178.0	203.7	207.3	218.2	201.8	246.8	251.4
15. – Hired Farm Labor	1971=100	211.0	213.0	208.6	214.5	217.9	223.9	225.4	220.4	228.0	232.8
16. – Interest	1971=100	244.8	244.8	244.8	284.5	284.5	284.5	284.5	284.5	310.6	310.6
17. Farm Prices of Ag. Prod.[d]	1971=100	189.9	187.1	189.6	192.7	206.8	209.9	221.9	206.9	234.3	N.A.
Input and Credit											
18. Farm Impl. & Equip. Sales[e]	$ mil.	379.1	283.5	1,124.6	153.9	372.9	418.8	342.4	1,288.0	N.A.	N.A.
19. Employment in Agriculture[a]	'000	463.7	463.7	464.0	458.0	462.3	279.3	490.3	473.0	500.0	526.3
20. Av. Farm Labor Rates[d]	$/hr.	3.61	3.66	3.56	3.67	3.73	3.78	3.84	3.76	3.89	3.95
21. Av. Hourly Earnings-Manuf.	$/hr.	6.44	6.57	6.38	6.67	6.77	6.87	7.03[c]	6.84	7.20	7.39
22. F.C.C.-Gross Loan Disburs.	$ mil.	175.7	125.4	508.8	78.4	127.8	205.7	121.7	533.6	35.4	174.7
23. CPI – All Items	1971=100	162.6	166.1	160.8	169.2	173.3	177.7	180.5	175.2	184.6	189.4
24. – Food at Home	1971=100	182.7	188.6	178.8	194.8	208.3	218.7	216.4	209.6	228.5	237.9
25. – Food Away from Home	1971=100	188.3	190.0	187.0	192.6	194.9	202.2	207.3	199.3	213.1	220.8
26. Industry Selling Price Index – Food & Beverage	1971=100	187.9	189.2	185.9	194.9	203.9	209.5	213.5[c]	205.5[c]	225.5	229.3

continued

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE (concluded)

Item	Units or Base	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual	1979 I	1979 II
Other Indicators											
27. Unemployment Rate	%	8.2	8.4	8.1	8.4	8.6	8.5	8.2	8.4	8.0	7.8
28. Exchange Rate	$U.S.	1.07	1.10	1.06	1.11	1.13	1.14	1.18	1.14	1.19	1.17
29. Av. Rate on New Demand Loans	%	8.6	8.7	8.9	8.7	9.7	10.0	12.32	10.18	12.31	12.55
30. Quarterly Pop. Est.	mil.	23.28[b]	23.34[b]	23.26[b]	23.39[b]	23.44[b]	23.50	23.55	23.48	23.60	23.64

[a] Seasonally adjusted at annual rates.
[b] Revised.
[c] Preliminary.
[d] Excludes Newfoundland.
[e] Excluding repair parts.
[f] N.A. = Not available.

Sources: All items are from the *Canadian Statistical Review,* Statistics Canada, Catalogue No. 11-003; Agriculture Canada, Policy, Planning & Economics Branch, Marketing and Trade Division; Statistics Canada, Catalogue No. 71-001 and Catalogue No. 21-002; the Farm Credit Corporation; or the Bank of Canada Review.

NOTES

AGRICULTURAL OUTLOOK CONFERENCE

The 1979 annual Agricultural Outlook Conference will be held at the Government Conference Centre in Ottawa, December 10 and 11.

The conference brings together heads of the federal and provincial departments of agriculture, representatives from farm organizations, universities, consumer groups, agribusiness, and other government departments to discuss agricultural prospects for the coming year.

Agriculture Minister John Wise will open the conference at 9 a.m., December 10. The general conference chairman will be Deputy Agriculture Minister Gaétan Lussier.

Morning speakers on the first day will discuss general economic trends, the world agriculture and food outlook, Canadian agricultural markets in 1980, and expected farm costs and incomes.

After lunch, there will be concurrent sessions dealing with cattle and hogs, grains and oilseeds, horticultural products, poultry and eggs, dairy, and farm costs and incomes.

On Tuesday, December 11, the conference will begin with an outlook for food prices, followed by a discussion of cost changes in the processing, distributing, and retailing sectors.

A panel presentation at 10:15 a.m. Tuesday will include leaders from producer, processor, retailer, and consumer organizations.

The afternoon session will include closing remarks and a conference summary by Mr. Wise, followed by a question period with the Minister.

PUBLICATIONS

The following five publications are available free from the Publications Manager, Policy, Planning and Economics Branch, Agriculture Canada, Room E-152B, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.

Market Commentary – Animals and Animal Products. A.M. Boswell and G.E. Pugh. October 1979. 27 p.

Fertilizer Statistical Bulletin. Z. Piracha. September 1979. 57 p. Publication No. 79/11. Pocket-size edition.

Food Market Commentary. Autumn 1979. 32 p. Cat. No. A80-751/Vol. 1, No. 1.

Fresh Fruit and Vegetables: What's Available and When. N.L. Longmuir. September 1979. 14 p. Publication No. 79/12.

Market Commentary – Grains and Oilseeds. C.V. Fulton, J. Gellner, J.W. Duncker, and G. Vitonova. September 1979. 40 p.

The following three publications are available free from Information Services, Agriculture Canada, Ottawa, Ontario, K1A 0C7.

Beef Import Consultative Committee – Summary of Views of Interested Parties. B. Hargrave, M.P., Chairman. September 1979. 405 p.

Canadian Record of Performance for Dairy Cattle – Summary Report 1978. 1979. 29 p.

Farm Machinery – Financial Management. B.A. Hackett – B.C. Ministry of Agriculture and W. Stokes – Agriculture Canada. 1979. Three Booklets: 1. Introduction to Machine Costs, 4 p.; 2. Calculating Machine Costs, 7 p.; and 3. What Should I Charge for Custom Work, 4 p.

The Agricultural Potential of Marginal Areas, The Arkleton Lecture 1979. Professor J.M.M. Cunningham. 1979. 19 p. *Available for £1.50 from the Arkleton Trust and the Hill Farming Research Organization, Enstone, Oxford, OX7 4HH, England, U.K.*

Agricultural Statistics for Ontario, 1978. July 1979. 54 p. *Available free from the Ontario Ministy of Agriculture and Food, Queen's Park, Toronto, Ontario, M7A 1B7.*

B.C. 1978 Agriculture Statistics Yearbook. April 1979. 93 p. *Available free from the Ministry of Agriculture, Province of British Columbia, Publications Office, Parliament Buildings, Victoria, British Columbia, V8W 2Z7.*

Lacombe Research Hi-Lites, 1978. 1979. 27 p. *Available free from the Agricultural Canada Research Station, Lacombe, Alberta, T0C 1S0.*

Ontario Farm Management Analysis Project 1978. Prepared by the University of Guelph's School of Agricultural Economics and Extension Education in cooperation with the Extension Branch, Ontario Ministry of Agriculture and Food. Publication No. AEEE/79/9. July 1979. 19 p. *Available free from the University of Guelph, Guelph, Ontario, N1G 2W1.*

Sources of Farm Business Credit in Alberta. Harry Warne. June 1979. 29 p. *Available free from Alberta Agriculture, 9718 – 107 Street, Edmonton, Alberta, T5K 2C8.*

IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we shall try to accommodate you.

When forwarding your "In Reply" or letter indicate if we may publish your comments in a subsequent issue.

Dr. Marvin Sundstrom, a geography professor at the University of Lethbridge, Lethbridge, Alberta, liked V. McCormick's article, "The Cheese Industry in Canada," which appeared in our August issue. Being one of his research areas, he needs all the current information available on the topic. Dr. Sundstrom also said that the tables provided useful statistics on trends in the industry. He also finds the notes and listing of publications extremely useful. "I use the latter to help keep up on new material relating to Canadian agriculture."

William A. Gauske, a dairy farmer, R.R. #2, Millet, Alberta, T0C 1Z0, also found the McCormick article useful. He said that he rarely sees reports on farmers' expenses and that the public gets the impression that farmers are reaping huge profits.

Rand C. Luttwing, P. Ag., an agriculture specialist with the Saskatchewan Power Corporation, 2025 Victoria Avenue, Regina, Saskatchewan, S4P 0S1, found the entire August issue very useful. He particularly liked "An Economic Assessment of Dryland Cropping Programs in the Prairie Provinces: Expected Net Incomes and Resource Requirements" by R.P. Zentner *et al.* because the "economics of cropping programs are of major concern to me since I am just starting to farm and must invest my money wisely."

Mr. Robert N. Plank, Assistant Regional Manager, Farm Credit Corporation, Box 249, Kelowna, B.C., V1Y 7N5, said that F.L. Tung's and W.D. Jones' article, "Forecasting Farm Credit Requirements for 1981," in our June issue was directly related to his work. "The method of study and assumptions made were provided in detail sufficient to a non-economist. The use of three levels of projection was useful."

P.L. Buder, a flat glass quality assurance supervisor, #3-846 – 2nd Avenue West, Owen Sound, Ontario, N4K 2C3, liked I.F. Furniss' article, "Energy Use in the Canadian Horticultural Crop and Food System," also in our June issue. "I am seriously researching the potential for competitive cost tomatoes, Canadian grown, by the hydroponics – greenhouse system."

IN REPLY TO AUTHORS AND EDITORS REGARDING OCTOBER 1979 *CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

(1) The Multilateral Trade Negotiations and Canadian Agriculture
(2) Variability of High Protein Meal Prices
(3) Low Income Farm Families in 1976

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

not useful ______________________________ very useful
1 2 3 4 5 6 7 8 9 10

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr., Ms., or Dr.) ______________________________ Occupation ____________________
(Please Print)

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Please return the above to:

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Information Services
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
Canada
K1A 0C5

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

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CANADIAN FARM ECONOMICS

Agriculture Canada

HON. JOHN WISE, MINISTER – GAÉTAN LUSSIER, DEPUTY MINISTER

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PROSPECTS FOR EXPANDING CANADA'S AGRICULTURAL EXPORTS TO EAST ASIA

Soe Lin*

High economic and population growth rates being realized in eight East Asian countries – Singapore, South Korea, Taiwan, Thailand, Hong Kong, the Philippines, Malaysia, Indonesia – have considerably increased prospects for expanding Canadian Agricultural exports to these markets.

Increased efforts should be made to exploit opportunities that have developed in these markets for income responsive items such as dairy products, fruits and vegetables and hides and skins.

INTRODUCTION

The conclusion of the Tokyo Round of the Multilateral Trade Negotiations and the less restrictive trading environment that can be expected to result have provided fresh impetus for countries to devote more attention to developing existing and new export markets. Canada, small in terms of population, but an important trading nation, is no exception. In the agricultural sector, particularly, Canada enjoys an advantage in grains and oilseeds and has a strong potential to compete internationally in other commodities such as meat, livestock products and various processed agricultural products. Against this background, the rising demands for food created by the high level of income and population growth in many countries around the world provide a challenge and an opportunity for Canada to further expand its agricultural exports.

One region deserving particular attention in relation to an increased potential for Canadian agricultural exports is the group of countries in East Asia which are progressing from the developing to the developed stage in their economic status. Eight countries have been included in this Group of East Asian Countries (GEAC) – Hong Kong, Indonesia, South Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand. Two factors have influenced the choice of these countries: the markets provided by these countries are less well known than Canada's traditional markets in Europe, the United States and other Pacific countries such as Japan and China; the size of the markets is rapidly expanding because of the high growth rates in income and population.

An additional factor is that five of these eight countries (Indonesia, Singapore, Thailand, Malaysia and the Philippines) are members of the Association of South East Asian nations (ASEAN), a regional political and economic organization formed in 1967. In recent years ASEAN's identity as an important economic organization has become more defined. Initiatives have been taken to transform the organization into a regional trading bloc and also to forge closer links with the European Economic Community (EEC). An agreement on ASEAN Preferential Trading Arrangements signed in Manila in February 1977, and a meeting held in Jakarta in February 1979 between government officials, bankers and industrialists from ASEAN and

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*Soe Lin is an economist with the International Trade Policy Division, Policy, Planning and Economics Branch, Agriculture Canada, Ottawa. The author extends his appreciation to Diana Wisner, a student who worked with the International Trade Policy Division last summer, for assistance in preparing this article, and also to Jim Lohoar of the Division for helpful comments on a preliminary version.

200 industrialists from the nine EEC countries are positive steps towards these objectives.

This paper first discusses the general economic performance of these countries as a group while pointing out special factors which are relevant to each of them. Attention is then focused on the agricultural production and trade of GEAC, with special attention to exports of Canadian agricultural products to its individual members. Canada's total agriculture exports to these eight countries disaggregated by major commodity group are then discussed, and for some of these groups a comparison is made with U.S. performance. In the concluding section, the prospects of Canadian agricultural exports to GEAC are analyzed.

GENERAL ECONOMIC TRENDS IN EAST ASIA

Population

Table 1 provides a statistical picture of the general economic trends in GEAC. Growth rates in this table are calculated for 1972-77, the latest period for which data were available.

The total population of GEAC in 1977 was 305.4 million, with an average annual growth rate of 2.3 percent. The growth rate during the past five years was highest in the Philippines, followed by Malaysia, Thailand, Indonesia, Hong Kong and Taiwan. South Korea and Singapore had annual population increases of less than 2 percent.

The medium-term U.N. population forecast suggests that the absolute level of GEAC's population will increase 39 percent in just more than a decade and that population gains will be highest in the Philippines, followed by Thailand and Malaysia.

Gross Domestic Product

The total gross domestic product (GDP), the value of final goods and services produced, in the domestic economies of GEAC in 1977 totaled U.S. $166 billion, compared with the Canadian GDP of U.S. $179 billion.

In terms of per capita GDP, Singapore ranks highest among GEAC with U.S. $2,870, followed by Hong Kong, Taiwan, Malaysia, South Korea, the Philippines and Thailand. Indonesia, with a per capita GDP of U.S. $312, is lowest. In comparison, the Canadian per capita GDP in 1977 was U.S. $8,652.

GEAC had an average growth rate in per capita real GDP of 6.0 percent during the period, compared with the 2.7-percent growth rate in per capita real GNP achieved by Canada. GEAC's relatively high growth rate is particularly impressive because it took place during the period when the international economy was unstable and suffered from unprecedented rates of inflation and unemployment.

Turning to the individual per capita real GDP growth rates, it is clear that South Korea is the undisputed leader. Its 9.8-percent growth rate easily surpasses the rates of most if not all developed industrial nations during the same period. South Korea was followed by Taiwan at 7.4, Hong Kong at 7.1 and Singapore at 5.9 percent. The Philippines' 3.8-percent growth rate in per capita real GDP is the lowest of the group, but is still favorable compared with Canada's 2.7-percent rate during this period. Hence the performance of GEAC's economies in recent years has been undoubtedly impressive.

Trade

The total value of GEAC's exports in 1977 was U.S. $60.6 billion and the total value of imports was U.S. $59.9 billion, allowing the group to enjoy a small trade surplus of U.S. $720 million. Indonesia, Malaysia and Taiwan had trade surpluses in 1977 while Singapore, Thailand, the Philippines, Hong Kong and South Korea registered deficits. In 1977 Indonesia was the leading exporter in the group with exports valued at U.S. $10.8 billion (FOB). South Korea was a close second with U.S. $10 billion. The Philippines exported U.S. $3 billion and ranked lowest. The major exports from GEAC are petroleum products, forest products, rubber, tin and palm oil.

South Korea, Hong Kong and Singapore were the major importers within GEAC in 1977. Each country imported more than U.S. $10 billion worth of goods (CIF value). Industrial raw materials, machinery and beverages are major import items.

To obtain a more realistic picture of the international trading position of individual members of GEAC, export and import growth rates were calculated (Table 1).

South Korea's superior export performance is evident from its export growth rate (in real terms) of 27.5 percent, almost twice that of Taiwan, the closest rival, whose exports grew at a rate of 13.8 percent. Malaysia showed the smallest growth since exports increased only 7.6 percent. Canada's export growth rate of 3.7 percent

TABLE 1. GENERAL ECONOMIC INDICATORS AND ANNUAL GROWTH RATES (1972-77) FOR GEAC

	Population			Gross Domestic Product				Total Exports		Total Imports		Balance of Trade
Country	Total 1977	Annual Growth Rates '72-'77	U.N. 1990 Forecast	Total 1977	GDP Per Capita 1977	Real GDP per Capita Annual Growth Rate	1979 Real GDP Growth Rate Forecast	1977 FOB	Annual Growth Rates, Volume Index	1977 CIF	Annual Growth Rates, Volume Index	1977 Total
	millions	%	millions	billion U.S.$	U.S.$	%	%	billion U.S.$	%	billion U.S.$	%	Billion U.S.$
Hong Kong	4.6	2.2	5.1	11.7	2,543	7.1	9.0	9.6	7.9	10.5	6.8	−0.9
Indonesia	143.4	2.6	196.6	44.7	312	4.9	5.0	10.8	11.0	6.2	16.2	4.6
South Korea	36.5	1.8	45.1	31.6	866	9.8	9.5	10.0	27.5	10.8	14.9	−0.8
Malaysia	12.6	2.8	18.3	12.7	1,008	4.9	7.5	6.1	7.6	4.5	5.9[a]	1.5
Philippines	45.0	2.9	70.1	20.8	462	3.8	5.0	3.1	9.5	4.3	3.6	−1.2
Singapore	2.3	1.4	2.8	6.6	2,870	5.9	7.0	8.2	11.1	10.5	7.4	−2.2
Taiwan	16.7	2.0	21.2	19.6	1,174	7.4	7.5	9.3	13.8	8.5	11.4	0.827
Thailand	44.3	2.8	66.8	18.2	411	4.6	5.0	3.5	9.8	4.6	6.7	−1.1
Totals and Averages	305.4	2.3	426.0	165.9	1,206	6.0	6.9	60.6	12.3	59.9	9.1	0.7

[a]Calculated as total value/unit value.

Source: *International Financial Statistics,* IMF. *Business Asia,* December 22, 1978.

TABLE 2. AGRICULTURAL PRODUCTION AND TRADE IN GEAC, 1972-77

Country	Per Capita Food Production	Agricultural Imports		Agricultural Exports		Balance of Trade in Agri-cultural Products	Major Agricultural Imports	Agricultural Imports from Canada	
	Annual Growth Rate	Total 1977	Annual Growth Rates, Volume Index	Total 1977	Annual Growth Rates, Volume Index	1977	From Canada (1975-78)	Total 1978	Annual Growth Rates (1975-78)
	%	million U.S.$	%	million U.S.$	%	million U.S.$		million Can. $	%
Hong Kong	−5.4	2,002	9.8	338	8.5	−1,664	wheat, fresh apples & crab apples, soya beans	24.8	32.0
Indonesia	1.3	1,196	15.4	1,807	19.5	611	wheat, skim milk powder	1.1	−51.0
South Korea	3.8	1,517	12.3	443	15.4	−1,074	wheat, wheat flour, purebred dairy cattle, raw cattle hides, flaxseed, rapeseed	54.4	52.0
Malaysia	0.4	892	8.7	2,560	15.1	1,668	wheat	5.2	67.0
Philippines	3.3	364	9.2	1,634	15.7	1,270	wheat, malt, skim milk powder	8.7	−32.0
Singapore	9.9	1,220	12.9	850	18.6	−370	rapeseed, soya beans	9.0	34.0
Taiwan	1.7[a]	1,060	36.2	342	5.2	−720	skim milk powder, wheat, raw cattle hides, flaxseed, fresh apples and crab apples	18.0	132.0
Thailand	1.6	344	17.1	2,189	18.6	1,845	skim milk powder	4.8	111.0
Totals & Aveages of Eight Countries	2.1	8,595	15.2	10,163	14.6	1,566		12.6	21.0

[a]Agricultural production.

Sources: *Business Asia,* December 22, 1978.
"Agricultural Situation," Supplement 2 to *World Agricultural Situation 18,* USDA.
External Trade Division, Statistics Canada.

during this period is quite small compared with GEAC's remarkable export growth rates.

In recent years the high GEAC export growth rates have led to a high level of economic activity which has permitted these countries to sustain a significant expansion in imports.

Table 1 shows that imports in real terms grew 16.2 percent in Indonesia, 14.9 percent in South Korea and 11.4 percent in Taiwan. The Philippines, at the bottom of the list, has an import growth rate of 3.6 percent, lower than Canada's 5.4-percent growth rate.

AGRICULTURAL PRODUCTION AND TRADE IN EAST ASIA

Food Production

Singapore achieved a growth rate of per capita food production of 9.9 percent during 1972-77 (Table 2). However, the fact that Singapore's per capita food production declined 15 percent between 1974 and 1976 clearly indicates that there has not been a steady growth of per capita food production. In fact the apparent high growth rate of per capita food production registered for the 1972-77 period was largely a direct result of a

17.6-percent decline in 1972 compared with the 1971 figure and a 45.4-percent increase in 1977 compared with the 1976 rate.

The relatively high growth rates in food production achieved by South Korea and the Philippines, however, reflect increased use of technological advancements and better farm management. Continuing high population growth rates, partly caused by the influx of refugees from other countries in the region, and declining food production account for a 5.4-percent decrease in Hong Kong's per capita food production.

GEAC's Agricultural Trade

In 1977, GEAC exported U.S. $10.2 billion worth of agricultural products. This represents 17 percent of the group's total exports. The major items exported are rice, rubber, palm oil, cassava, sugar and coffee.

Agricultural product imports by GEAC in 1977 were valued at U.S. $8.6 billion, representing 14 percent of the group's total merchandise imports. Major items in agricultural imports are rice, hides and skins, wheat, oilseeds, vegetable oils, meat and dairy products.

GEAC consequently had a U.S. $1.6 billion surplus in agricultural products trade in 1977. Indonesia, Malaysia, the Philippines and Thailand were net exporters while Hong Kong, South Korea, Singapore and Taiwan were net importers of agricultural goods in 1977.

Growth rates of agricultural exports (in real terms) have been highest in Indonesia, Singapore and Thailand. This is attributable to increases in rubber, coffee and cassava exports.

Growth rates of agricultural imports (in real terms) have increased most rapidly in Taiwan, Thailand, Indonesia and South Korea. The growth rate of agricultural imports (in real terms) exceeded the growth rate of total imports (in real terms) for all members of GEAC, with the exception of Indonesia and South Korea. Agricultural imports as a share of total imports have therefore increased in six of the eight member countries.

In 1978, GEAC imported U.S. $126.0 million worth of agricultural goods from Canada. In 1977, Canada's share of GEAC's total agricultural imports was only 1 percent. This indicates how much room there is for Canada to increase agricultural exports to this new and growing market.

In 1978, South Korea was Canada's most important customer (Table 2) within GEAC for agricultural exports, followed by Hong Kong and Taiwan.

Canadian exports of agricultural products to Taiwan have grown at an annual rate of 132 percent and to Thailand at an annual rate of 111 percent during the 1975-78 period. For Taiwan, raw cattle hides, tallow, dehydrated alfalfa, rapeseed oil, cake and meal were largely responsible for raising the value of Canadian agricultural exports from $1.4 million in 1975 to $18 million in 1978. Canada's exports of agricultural goods to Thailand increased from $0.5 million in 1975 to $4.8 million in 1978 mainly as a result of skim milk powder exports increasing from $54,000 to $4.5 million. Average Canadian food aid (multi and bilateral)[1] to Taiwan for 1976-78 amounted to $1.2 million (9 percent of agricultural exports) and to Thailand amounted to $100,000 (3 percent of agricultural exports).

Although the growth rate of Canadian agricultural exports to Malaysia (67 percent) appears impressive, there is considerable fluctuation in exports from year to year. Wheat and tobacco were mainly responsible for the record exports in 1978.

South Korea is another market that deserves close scrutiny not only on account of the steady and high growth rates of Canadian agricultural exports during the past four years, but also for the high potential that exists for a wide variety of agricultural goods in this fast-growing market. In this respect, purebred dairy cattle, raw cattle hides and tallow deserve particular mention because of their responsiveness to income growth.

Canadian exports of agricultural products to Singapore have been growing at a rate of 34 percent during the past four years. Exports of soybeans and dried split peas in particular have made tremendous gains in this period.

Although the growth rate of Canadian agricultural exports to Hong Kong (32 percent) seems low relative to that of some GEAC members, in comparison this market is highly diversified and ranks second only to South Korea in terms of value. Soybeans, oilcake and meal, crude herbs and medicinal plants, spring wheat, animal feeds, vegetables and cured sausages have been high growth items. There is also a high and

[1] See Diana Wisner's "Canada's Agriculture Trade with Developing Countries," in a forthcoming edition of CFE.

TABLE 3. VALUE OF CANADA'S AGRICULTURAL EXPORTS TO GEAC, BY MAIN COMMODITY GROUPING, 1975-78

Exports	1975	1976	1977	1978	Averages '75-'78	Growth Rates '75-'78	Increase 1977-78
	–			$ million		–	– % –
Grains	38.2	35.4	47.9	9.3	32.7	−27.0	−81.0
Grain Products	2.9	7.2	5.5	9.5	6.3	48.0	73.0
Animal Feeds	0.2	0.9	2.0	3.3	1.6	152.0	65.0
Oilseeds	0.9	5.9	8.6	11.9	6.8	134.0	38.0
Oilseed Products	0.2	1.0	3.9	5.0	2.5	130.0	28.0
Animals Living	0	0	0.5	2.8			460.0
Meats	0.3	0.7	0.8	0.6	.6	26.0	−25.0
Other Animal Products	17.4	25.7	39.7	53.6	34.1	45.0	35.0
Dairy Products	1.0	2.8	17.7	14.3	8.9	141.0	−19.0
Poultry and Eggs	2.9	1.0	1.1	1.4	1.6	−21.0	27.0
Fruit and Nuts	2.5	2.5	3.1	4.0	3.03	17.0	29.0
Vegetables, Excl. Potatoes	0.1	0.7	0.9	1.9	.9	164.0	111.0
Potatoes and Products	0	0	0.1	0.3	–	–	200.0
Seeds for Sowing	0	0	0	0	–	–	
Maple Products	–	–	–	–	–	–	
Sugar	–	0	–	–	–	–	
Tobacco, Raw	1.2	0.6	0.4	3.2	1.35	38.0	700.0
Vegetable Fibers	–	–	0	–			
Plantation Crops	0	–	–	–			
Other Agricultural Products	2.2	1.7	2.9	2.9	29.3	30.0	69.0
Total	70.0	86.1	135.1	126.0	104.3	21.0	−7.0

Source: External Trade Division, Statistics Canada.

steady demand for edible gelatin, raw cattle hides and fresh apples.

CANADA'S AGRICULTURAL EXPORTS TO EAST ASIA AND A SELECTIVE COMPARISON WITH U.S. EXPORT PERFORMANCE

In Table 3, Canadian agricultural exports to GEAC are disaggregated by major commodity grouping. Summary statistics are also shown. Averages and growth rates (in terms of value) were calculated for the period 1975-78.

Table 4 presents a selection from the commodity groups in Table 3, approximately aggregated as necessary, with comparisons between Canadian and U.S. exports of these commodity groups to GEAC. Summary statistics are also provided.

Two commodity groups, grains and certain animal products, comprise approximately 64 percent of Canada's agricultural exports to GEAC. While grain exports registered a negative growth rate of 27 percent with a consequent decline in value in 1978 compared with the 1975 level, there has been a strong and sharp growth in exports of certain animal products. Growth rates exceeding 130 percent have been realized in the export of vegetables and potatoes, animal feeds, dairy products and oilseeds and oilseed products, but the export value of none of these commodity groups exceeded $1 million in 1975, the base year for calculating the growth rate. The export value of three commodity groups – grains, meats and dairy products – declined in 1978 compared with 1977 figures.

Table 4 shows that although Canadian agricultural exports of selected commodity groups to GEAC have grown at a slightly higher rate than those of the United States in terms of export value, the United States exports about sixteen times Canada's amount. Moreover, Canadian agricultural exports to GEAC fell 13 percent in 1978, compared with 1977 levels, while U.S. agricultural exports increased 32 percent. It is clear that the Canadian share of GEAC's agricultural commodity market is minute compared with that of the United States, and the statistics suggest that this state has not improved during the past year. However, a more encouraging picture of Canada's competitive position in GEAC relative to that of the United

TABLE 4. AGRICULTURAL EXPORTS TO GEAC BY SELECTED COMMODITY CLASS

Exports	1975		1976		1977		1978		Averages '75-'78		Growth Rates '75-'78		Increase 1977-78	
	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.
	–						million $ Can.					–	– % –	
Grains, Including[a] Wheat Flour	41.1	655.6	42.6	719.4	51.9	683.7	16.6	932.7	38.0	747.8	−26	4.0	−68.0	36.0
Meat and Meat[b] Products	.3	6.8	.7	9.6	.8	11.6	.6	31.0	.6	14.8	26.0	65.0	−25.0	167.0
Animal[c] Products	15.6	88.9	24.2	131.3	38.4	165.9	52.2	205.8	32.6	148.0	49.0	32.0	36.0	24.0
Tobacco, Unmanufactured	1.2	99.4	.6	117.6	.4	153.7	3.2	178.6	1.3	137.3	38.0	21.0	700.0	16.0
Dairy Products	1.0	7.0	2.8	17.6	17.7	50.0	14.3	17.4	8.9	23.0	141.0	35.0	−19.0	−65.0
Fruits, Nuts, Vegetables and Preparations	2.6	70.0	3.2	83.9	4.0	107.8	5.9	154.8	3.9	104.1	31.0	30.0	46.0	44.0
Oilseeds	0.9	221.1	5.9	207.5	8.6	288.7	11.9	377.4	6.8	273.6	134.0	19.0	38.0	30.0
Oilseed Products[d]	.2	8.4	1.0	6.2	3.9	15.1	5.0	50.4	2.5	20.0	189.0	81.0	28.0	234.0
Totals	62.9	1157.2	81.0	1293.1	125.7	1476.5	109.7	1948.1	94.8	1468.7	20.0	19.0	−13.0	32.0

[a]Wheat and flour and feed grains.
[b]Does not include poultry and poultry products.
[c]Hides, skins and tallow.
[d]Oilcake and meal and vegetable fats and oils.

Source: Canadian Statistics obtained from External Trade Division, Statistics Canada
United States Statistics obtained from Agricultural Situation, Review of 1978 and Outlook for 1979, Supplement 2 to World Agricultural Situation 18, U.S.D.A.

States is obtained when a comparison is made on the basis of individual commodity groups. In the case of two commodity groups – grains, including wheat flour, and meat and meat products – the Canadian market share relative to that of the United States has definitely worsened. But in the case of oilseeds, oilseed products and dairy products, Canada has made tremendous gains not only in absolute terms but relative to U.S. gains as well.

SUMMARY AND PROSPECTS FOR FUTURE GROWTH

Relatively high economic and population growth rates have been the recent trend in GEAC's economic performance. The evidence seems to indicate that part of the high GDP growth rate is attributable to export expansion. If this is the case, the less restrictive trading environment created by the recently concluded Multilateral Trade Negotiations will contribute towards sustaining this growth.

Growth rates in economic activity for GEAC forecasted for 1979 (Table 1) show that although the high annual rates achieved in the recent past may not be sustained, the absolute levels of growth rates are still high. For example, the forecasted growth rates for Indonesia, the Philippines and Thailand are 5 percent but for the remaining five countries it ranges from 7 percent for Singapore to 9.5 percent for South Korea.

The average forecasted growth in GDP for GEAC is 6.9 percent, compared with the 3.5 – 4.5-percent growth rate forecast for Canada.

The medium-term U.N. population forecast for GEAC shows that its population should be 426 million in 1990. This represents a 39-percent increase during the next 11 years or an annual average increase of 3.5 percent, compared with a 2.7-percent annual average increase during the 1972-77 period.

The record of GEAC's domestic food production increases during the period has been unimpressive, except for that of South Korea and the Philippines. The average growth rate for GEAC, excluding Singapore, whose high growth rate as already explained is distorted, is only 1.1 percent.

Thus the underlying economic trends of the domestic supply side as well as the demand side suggest that GEAC's imports of agricultural products will remain strong in the near future. The increasing share of agricultural imports in total imports in six of the eight member countries is a reflection of low production and high food demand.

If the recent pattern of North America's agricultural exports to GEAC is any guide it seems that demand by GEAC is moving more and more towards income elastic agricultural imports such as meat and meat products, hides and skins, dairy products and fruits and vegetables and away from cereals. On the other hand, the growth rates of oilseed imports are increasing rapidly, reflecting heavier demand for both vegetable oil and animal feed.

From Canada's perspective this perceived trend is encouraging, but the potential for increasing our market share has not yet been fully realized.

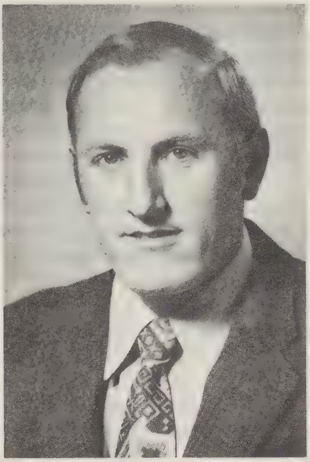
It is true that the U.S. exports to GEAC a considerable amount of rice and soybeans. Soybeans is a commodity which Canada has only recently developed as a potential export. Taiwan, South Korea and the Philippines also have strong political ties with the United States, thus giving the U.S. a non-economic advantage over Canada in exporting to GEAC.

Although these extraneous factors are valid, they cannot completely explain why the value of U.S. agricultural exports to GEAC was 16 times that of Canada's during the past four years.

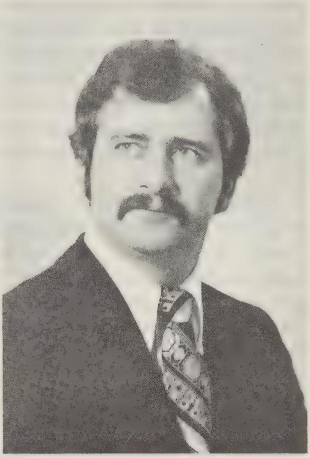
On the basis of the available statistics and economic trends analyzed above, it may be concluded that there is strong potential for further expansion of Canada's agricultural exports to GEAC. The markets of South Korea, Hong Kong, Malaysia, Singapore and Taiwan are especially promising for exports of dairy products, fruits and vegetables, hides and skins, oilseeds and of course wheat and wheat flour.

AN ECONOMIC ASSESSMENT OF DRYLAND CROPPING PROGRAMS IN THE PRAIRIE PROVINCES: INCOME VARIABILITY

*R.P. Zentner**



*B.H. Sonntag**



*J.B. Bole**

*U.J. Pittman**

Substantial differences exist among rotations, crop combinations, and soil zones in expected net incomes, seasonal resource use, and income variability. Hence a variety of cropping programs can be expected on farms in the Prairie Provinces.

INTRODUCTION

This is the second of two articles concerned with economic aspects of dryland cereal and oilseed rotations on Canadian prairie farms. In the first article (Zentner *et al.* 1979) expected net incomes and resource requirements were compared for three rotations and several crop combinations in the Brown, Dark Brown, and Black soil zones at various combinations of input and product prices.[1]

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[1] Readers should refer to this article, which appeared in the August 1979 issue of CFE, for a detailed discussion of the effects of changes in relative prices of inputs and products on optimal crop combinations and rotations, expected net incomes, and resource requirements.

Expected net income and seasonal distribution of resource requirements (especially labor) are important criteria in cropping program decisions. The calculation of expected net income, or profitability, accounts for quantities of resources used (costs) but not for the seasonality of resource requirements. For example, a rotation with a fairly uniform seasonal distribution of labor requirements might be chosen over one with high labor demands in some seasons despite lower expected net income. The relatively uniform seasonal distribution of labor requirements in rotations with a high proportion of fallow is an important factor contributing to the dominance of these rotations, even though other rotations might produce higher expected net income.

A further consideration in cropping program decisions is income variability arising from yield and price risk. Yield risk originates from variation in amount and seasonal distribution of rainfall, temperature, other climatic factors, insects, weeds, and diseases. Price risk arises from changes in input and product prices that the farmer cannot control.

This article examines differences in income variability among soil zones, rotations, and crop combinations resulting from yield and product price variability.

DATA SOURCES AND METHOD OF ANALYSIS

The crop production environment in the Prairie Provinces is characterized by highly variable precipitation (amount and seasonal distribution), high evaporation rates during the growing season, the variable length of growing seasons, different degrees of weed infestations, and periodic outbreaks of diseases and insects.[2] These characteristics differ by soil zone and have an important bearing on crop production practices within soil zones.

Different crops are not affected uniformly by adverse conditions. Some crops are more drought tolerant than others and are therefore better adapted to the drought-prone Brown soil zone (Alberta Agriculture 1976, Saskatchewan Department of Agriculture 1978). Crops that need fewer days to mature are better adapted to the shorter growing season in the Black soil zone (Saskatchewan Agriculture 1976). Winter wheat production, until recently, has been limited to parts of southern Alberta because of a lack of winter hardiness. New cultivars (e.g. Northstar), however, are extending the area in which this crop can be grown (Grant 1978). Insect pests and plant diseases sometimes restrict the crop options in particular areas.

These and other physical factors result in highly variable annual crop yields. The nature of yield variability is discernible from time series data on yields of annual crops on fallow and stubble on a regional basis (crop district, agricultural reporting areas, etc.). Unpublished data from Statistics Canada, provincial departments of agriculture, and other institutions were used to estimate standard deviations of yields,[3] by soil zone, for each crop on fallow and on stubble. Coefficients of variation[4] were calculated to obtain estimates of relative variability in crop yields. Long-term rotation studies at Agriculture Canada research stations and universities were used to validate the estimates (Austenson *et al.* 1970, Austenson and Khartri 1972, and Pittman 1977).

A farm level simulation model of dryland crop production (Zentner *et al.* 1978) was used to examine variability in expected net income arising from yield and price risk. Several crop combinations and rotations for three soil zones were examined at three grain price levels. The average price situation was based on average grain prices for the 1972-73 to 1976-77 crop years. High and low grain prices were one standard deviation of prices above and below the average for that period. The effects of yield variability (yield risk) were simulated by permitting yields to range one standard deviation above and below the mean for each price situation. Standard deviations of yields were based on 1962-74 data for each soil zone. One standard deviation above and below average does not cover the whole range of yields or prices; however, only in about 33 percent of the time (one out of three years) will yields or prices fall below or exceed one standard deviation from the mean. Input prices were held constant at 1978 levels.

Three case farms, one for each soil zone, were used in the analysis. Expected net incomes and standard deviations of net income were computed for about 16 crop combinations within three rotations for each case farm.

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[2]Descriptions of the agricultural climate of the Prairie Provinces are contained in the *Alberta Farm Guide (1976)* and *Guide to Farm Practice in Saskatchewan (1978)*.

[3]Standard deviation is a commonly used measure of variation or dispersion in a data set. The standard deviation (S.D.) is defined

as $\text{S.D.} = \sqrt{(1/N) \sum_{i=1}^{N} (Y_i - \overline{Y})^2}$, where $\overline{Y}$ is the sample mean.

[4]The coefficient of variation is a relative measure of variation. It is the sample standard deviation expressed as a percentage of the sample mean.

TABLE 1. YIELDS, STANDARD DEVIATIONS, AND COEFFICIENTS OF VARIATION FOR CROPS ON FALLOW AND STUBBLE IN THE BROWN, DARK BROWN, AND BLACK SOIL ZONES

Crop	Yield[a]	Standard Deviation[b]	Coefficient of Variation
	—	kg/ha —	%
Brown Soil Zone			
Winter Wheat — Fallow	2000	539	26.9
Flax — Fallow	855	302	35.3
Spring Wheat — Fallow	1819	458	25.2
— Stubble	1118	384	34.3
Barley — Fallow	2253	571	25.4
— Stubble	1504	501	33.3
Dark Brown Soil Zone			
Winter Wheat — Fallow	2371	532	22.4
Rape — Fallow	1067	264	24.7
Spring Wheat — Fallow	2095	438	20.9
— Stubble	1522	391	25.7
Barley — Fallow	2630	566	21.5
— Stubble	1972	523	26.5
Black Soil Zone			
Rape — Fallow	1280	275	21.5
— Stubble	893	258	28.9
Spring Wheat — Fallow	2405	445	18.5
— Stubble	1933	411	21.2
Barley — Fallow	3007	528	17.6
— Stubble	2447	490	20.0

[a] Average yields with optimal rates of N and P and average prices as calculated in the crops simulation model.
[b] Standard deviations were estimated for the period 1962 to 1974 from unpublished data from Statistics Canada and Alberta Agriculture.

The trade-off between level and variability of expected net income was demonstrated through calculation of expected net incomes for specified maximum income variability levels. These calculations were simulations of different levels of risk aversion.

YIELD AND INCOME VARIABILITY

The coefficients of variation for crops grown under similar conditions (e.g., on fallow) show that yields are more variable in the Brown soil zone than in either of the other two soil zones (Table 1). Fallowing reduces yield variability in all zones with the largest relative reduction in the Brown zone. The data also indicate substantial differences in relative yield variability among crops within zones. Oilseed yields are usually more variable than cereal crop yields.[5]

[5] The coefficients of variation in Table 1 probably underestimate true yield variability at the individual farm level since the numerators in the calculations are based on large area averages and the denominators are yields with optimal rates of N and P.

The standard deviation of net income is a mathematical expression of the amount of variability or risk associated with a particular cropping program. Low standard deviations indicate low income variability (risk) while high standard deviations indicate high risk. In all soil zones the variability in income decreased as the proportion of fallow in the rotations increased (Tables 2, 3, and 4). Standard deviations of income were higher with high grain prices than with low grain prices. Differences in yield and price variability among crops resulted in changes in the rank order of income variability among crop combinations for the three grain price situations.

Within rotations the crop combinations with spring cereals usually had the lowest income variability. Those with oilseeds generally had the highest.

Decision-making in risky situations usually entails a trade-off between expected net income and variability in income. A high level of expected net income generally requires giving up a low level of variability in expected net income and vice versa. The amount of income variability, or risk, that a farmer is willing to accept

TABLE 2. STANDARD DEVIATIONS OF NET INCOME BY CROP COMBINATION AND ROTATION IN THE BROWN SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

Crop Combination[a]	Grain Price Average	Low	High
	$/ha of rotation		
Crop Fallow			
Winter Wheat	31.39	23.98	39.96
Flax and Winter Wheat	36.33	27.02	47.72
Flax and Spring Wheat	34.51	25.39	45.37
Flax and Barley	34.04	25.66	43.92
Spring Wheat	27.56	20.80	35.30
Barley	26.48	21.24	32.36
Crop-Crop-Fallow			
Winter Wheat (Spring Wheat)	36.93	27.76	46.39
Winter Wheat (Barley)	36.83	28.58	45.60
Flax (Spring Wheat)	44.01	31.64	56.86
Flax (Barley)	43.84	32.41	56.04
Spring Wheat (Spring Wheat)	34.58	25.49	43.30
Spring Wheat (Barley)	34.43	26.31	42.51
Barley (Spring Wheat)	33.91	25.81	41.42
Barley (Barley)	33.79	26.60	40.58
Continuous Crop			
(Spring Wheat)	48.63	33.69	60.44
(Barley)	48.29	37.30	57.60

[a]Crops in parenthesis were produced on stubble.

TABLE 3. STANDARD DEVIATIONS OF NET INCOME BY CROP COMBINATION AND ROTATION IN THE DARK BROWN SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

Crop Combination[a]	Grain Price Average	Low	High
	$/ha of rotation		
Crop Fallow			
Winter Wheat	31.32	23.93	39.54
Rape and Winter Wheat	31.79	25.02	39.82
Rape and Spring Wheat	29.64	22.28	36.95
Rape and Barley	29.59	22.92	35.44
Spring Wheat	26.90	19.86	33.81
Barley	26.65	21.07	31.96
Crop-Crop-Fallow			
Winter Wheat (Spring Wheat)	37.05	27.76	46.51
Winter Wheat (Barley)	37.44	28.92	46.16
Rape (Spring Wheat)	37.97	28.28	46.91
Rape (Barley)	38.16	29.44	46.58
Spring Wheat (Spring Wheat)	34.18	25.10	42.71
Spring Wheat (Barley)	34.58	26.26	42.41
Barley (Spring Wheat)	34.11	25.89	41.62
Barley (Barley)	34.46	27.05	41.30
Continuous Crop			
(Spring Wheat)	48.76	35.42	60.59
(Barley)	49.55	38.80	59.30

[a]Crops in parenthesis were produced on stubble.

TABLE 4. STANDARD DEVIATIONS OF NET INCOME BY CROP COMBINATION AND ROTATION IN THE BLACK SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

	Grain Price		
Crop Combination[a]	Average	Low	High
		$/ha of rotation	
Crop Fallow			
Rape	33.15	25.37	41.62
Spring Wheat	27.07	19.66	34.18
Barley	23.19	17.64	28.26
Crop-Crop-Fallow			
Rape (Rape)	43.15	33.00	53.62
Rape (Spring Wheat)	38.58	29.37	48.86
Rape (Barley)	37.17	29.15	46.49
Spring Wheat (Rape)	43.42	31.71	55.18
Spring Wheat (Spring Wheat)	30.28	23.05	37.62
Spring Wheat (Barley)	33.12	25.34	41.25
Barley (Rape)	38.90	32.80	45.13
Barley (Spring Wheat)	28.75	22.77	34.70
Barley (Barley)	33.81	23.19	44.63
Continuous Crop			
(Rape)	63.26	47.94	78.25
(Spring Wheat)	49.55	36.98	63.11
(Barley)	45.18	36.09	55.20

[a]Crops in parenthesis were produced on stubble.

depends on personnal preferences, attitudes toward risk, and his financial situation. The risk-averse farmer will favor a cropping program with lower income variability than the farmer who is able or willing to accept high risk at any level of expected net income.

The trade-off between expected net income and income variability (risk) for the three soil zones indicated a positive relationship at all grain prices considered (Figure 1).[6] The positive relationship between expected net income and income variability indicates that a farmer's expected net income will increase as his aversion to risk decreases.

An alternative way of expressing the trade-off between expected net income and risk is to calculate the minimum expected net incomes associated with particular levels of risk aversion. The minimum expected net incomes for various levels of risk aversion (assuming a normal distribution) were calculated for the crop combinations and rotations for each soil zone (Tables 5, 6, and 7). To illustrate the meaning of the data, consider the top left entry of Table 5. This indicates that in three of four years the expected net income from the winter wheat-fallow cropping program in the Brown soil zone would be no lower than $31.62/ha of rotation. This was the highest minimum expected net income for this level of risk aversion and indicates that a farmer with this level of risk aversion would do best by selecting a winter wheat-fallow cropping program in this price situation.

In the Brown soil zone (Table 5) the crop-fallow rotation with winter wheat produced the highest minimum expected net income. Cropping programs with flax on fallow resulted in higher expected net incomes in about one out of four years. The continuous cropping program had higher expected net incomes in one out of three years than some of the crop combinations in the other rotations. This reflects the highly variable nature of soil moisture conditions in this soil zone. Yields and income for each hectare of rotation are relatively high in high rainfall years with continuous cropping.

In the Dark Brown soil zone (Table 6) the winter wheat-fallow rotation produced the highest minimum expected

[6]The equations that describe the curves have the following general form:

$$Y = aX^b, \quad (1)$$

where:

Y = expected net income ($/ha of rotation),
X = standard deviation of net income ($/ha of rotation), and
a,b = coefficients.

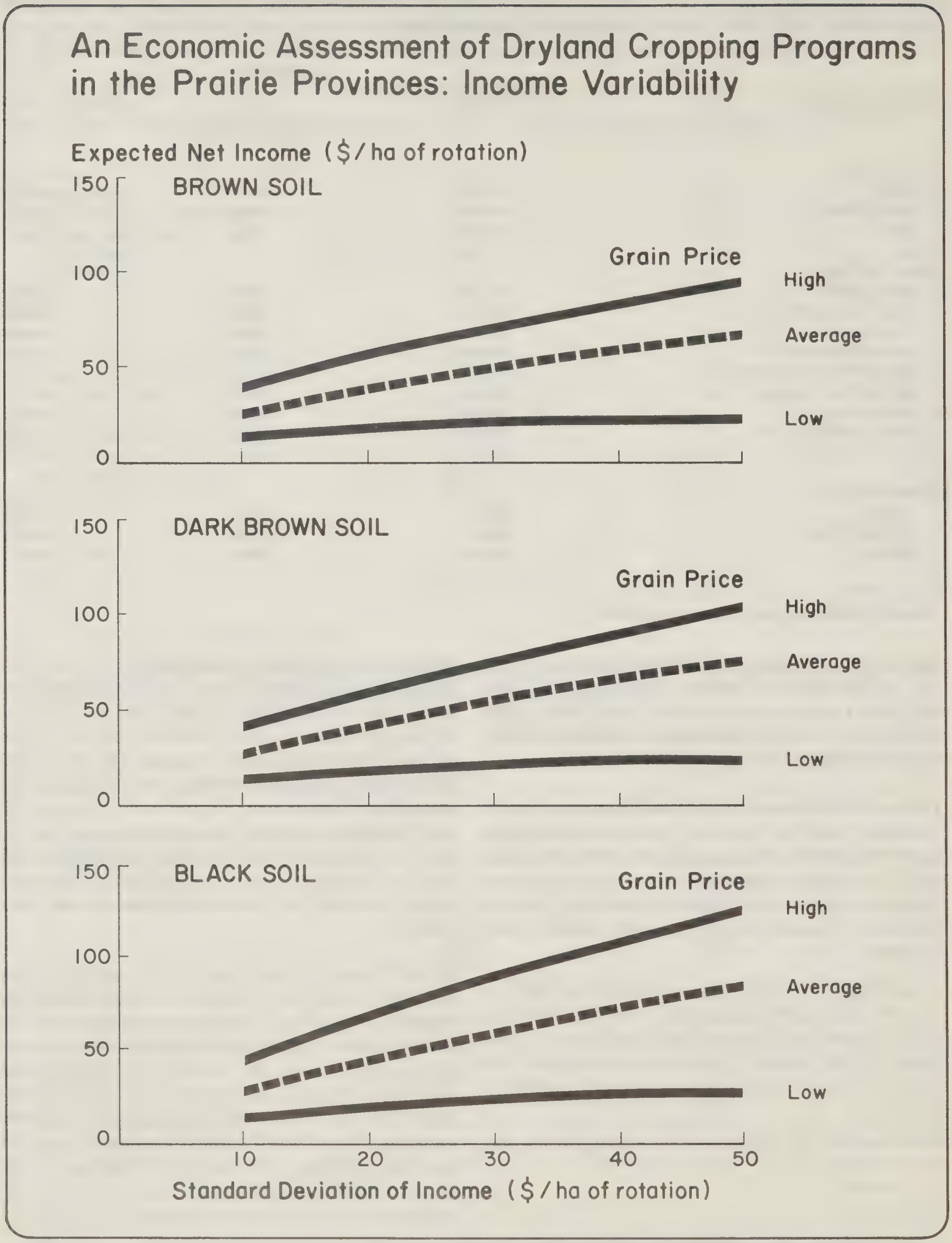
An Economic Assessment of Dryland Cropping Programs in the Prairie Provinces: Income Variability
Expected Net Income ($/ha of rotation)
BROWN SOIL
DARK BROWN SOIL
BLACK SOIL
Grain Price
High
Average
Low
150
100
50
0
10
20
30
40
50
Standard Deviation of Income ($/ha of rotation)

Figure 1

TABLE 5. MINIMUM EXPECTED NET INCOMES AT VARIOUS LEVELS OF RISK AVERSION FOR CROP COMBINATIONS AND ROTATIONS IN THE BROWN SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

	Average Grain Prices			Low Grain Prices			High Grain Prices		
	Risk Aversion[b]			Risk Aversion[b]			Risk Aversion[b]		
Crop Combination[a]	High	Medium	Low	High	Medium	Low	High	Medium	Low
				$/ha of rotation					
Crop-Fallow									
Winter Wheat	31.62[c]	52.81[c]	74.00	5.48[c]	21.66[c]	37.84[c]	57.11[c]	84.08	111.05
Flax and Winter Wheat	26.06	50.59	75.11[c]	−1.51	16.75	35.00	53.20	85.41[c]	117.62
Flax and Spring Wheat	22.75	46.04	69.33	−4.75	12.40	29.54	49.80	80.42	111.05
Flax and Barley	20.85	43.82	66.79	−3.88	13.44	30.75	45.42	75.06	104.70
Spring Wheat	25.17	43.77	62.37	−0.91	13.12	27.15	50.31	74.15	97.98
Barley	21.41	39.30	57.18	0.77	15.09	29.44	41.59	63.43	85.26
Crop-Crop-Fallow									
Winter Wheat (Spring Wheat)	21.32	46.24	71.16	−5.85	12.89	31.64	48.19	79.51	110.83
Winter Wheat (Barley)	23.00	47.84	72.69	−2.94	16.35	35.64	48.56	79.34	110.11
Flax (Spring Wheat)	13.54	43.25	72.96	−15.24	6.13	27.49	42.88	81.26	119.65[c]
Flax (Barley)	15.24	44.83	74.42	−12.33	9.56	31.44	43.27	81.11	118.96
Spring Wheat (Spring Wheat)	16.87	40.21	63.55	−10.18	7.04	24.26	43.67	72.89	102.11
Spring Wheat (Barley)	18.57	41.82	65.06	−7.26	10.50	28.26	44.04	72.74	101.44
Barley (Spring Wheat)	14.30	37.20	60.10	−9.04	8.37	25.79	37.77	65.73	93.69
Barley (Barley)	16.01	38.80	61.60	−6.13	11.83	29.79	38.16	65.55	92.95
Continuous Crop									
(Spring Wheat)	−2.99	29.84	62.66	−30.85	−8.10	14.65	26.48	67.28	108.09
(Barley)	2.05	34.65	67.26	−23.02	2.15	27.32	27.59	66.47	105.35

[a] Crops in parenthesis were produced on stubble.

[b] The income levels for high, medium, and low levels of risk aversion are the minimum expected income levels in three out of four years (probability = 0.75), one out of two years (probability = 0.50), and one out of four years (probability = 0.25), respectively.

[c] Refers to the cropping combination that provided the highest expected net income at that level of risk aversion and price situation.

TABLE 6. MINIMUM EXPECTED NET INCOMES AT VARIOUS LEVELS OF RISK AVERSION FOR CROP COMBINATIONS AND ROTATIONS IN THE DARK BROWN SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

	Average Grain Prices			Low Grain Prices			High Grain Prices		
	Risk Aversion[b]			Risk Aversion[b]			Risk Aversion[b]		
Crop Combination[a]	High	Medium	Low	High	Medium	Low	High	Medium	Low
				$/ha of rotation					
Crop-Fallow									
Winter Wheat	33.91[c]	55.06	76.20	1.21[c]	17.36[c]	33.52	65.36	92.06	118.76
Rape and Winter Wheat	29.12	50.59	72.05	-2.91	13.98	30.88	59.53	86.40	113.27
Rape and Spring Wheat	24.70	44.71	64.71	-6.32	8.72	23.76	54.74	79.68	104.63
Rape and Barley	23.07	43.05	63.03	-4.69	10.77	26.23	50.56	74.49	98.43
Spring Wheat	25.19	43.35	61.50	-6.55	6.87	20.28	55.85	78.67	101.49
Barley	21.91	39.89	57.87	-3.33	10.89	25.12	46.51	68.07	89.66
Crop-Crop-Fallow									
Winter Wheat (Spring Wheat)	30.68	55.67	80.69	-3.33	13.36	25.12	65.85[c]	97.24	128.64
Winter Wheat (Barley)	30.48	55.75[c]	81.02	-3.09	16.43	35.94	63.33	94.45	125.62
Rape (Spring Wheat)	24.26	49.87	75.51	-10.18	8.92	28.01	58.07	89.73	121.40
Rape (Barley)	23.98	49.75	75.51	-7.90	11.98	31.86	55.53	86.97	118.41
Spring Wheat (Spring Wheat)	24.77	47.84	70.91	-10.57	6.37	23.32	59.45	88.28	117.10
Spring Wheat (Barley)	24.55	47.89	71.23	-8.32	9.41	27.15	56.88	85.51	114.14
Barley (Spring Wheat)	22.60	45.62	68.47	-8.40	9.06	26.53	53.25	81.34	109.42
Barley (Barley)	22.38	45.65	68.91	-6.15	12.10	18.25	50.68	78.57	106.46
Continuous Crop									
(Spring Wheat)	22.11	55.01	87.93	-20.45	3.46	27.37	64.81	105.72[c]	146.62[c]
(Barley)	21.24	54.69	88.13[c]	-13.71	12.47	38.66[c]	56.88	96.92	136.96

[a] Crops in parenthesis were produced on stubble.

[b] The income levels for high, medium, and low levels of risk aversion are the minimum expected net income levels in three out of four years (probability = 0.75), one out of two years (probability = 0.50), and one out of four years (probability = 0.25), respectively.

[c] Refers to the cropping combination that provided the highest expected net income at that level of risk aversion and price situation.

TABLE 7. MINIMUM EXPECTED NET INCOMES AT VARIOUS LEVELS OF RISK AVERSION FOR CROP COMBINATIONS AND ROTATIONS IN THE BLACK SOIL ZONE FOR THREE GRAIN PRICE SITUATIONS

	Average Grain Prices			Low Grain Prices			High Grain Prices		
	Risk Aversion[b]			Risk Aversion[b]			Risk Aversion[b]		
Crop Combination[a]	High	Medium	Low	High	Medium	Low	High	Medium	Low
					$/ha of rotation				
Crop-Fallow									
Rape	37.03	59.40	81.78	−0.07	17.04	34.16	72.79	100.87	128.96
Spring Wheat	31.12	49.40	67.68	−5.46	7.80	21.07	66.69	89.76	112.83
Barley	26.85	42.51	58.17	−2.99	8.92	20.82	55.67	74.74	93.81
Crop-Crop-Fallow									
Rape (Rape)	36.38	65.50	94.63	−4.84	17.44	39.72	73.68	112.34	151.00
Rape (Spring Wheat)	43.69	69.73	95.76	0.12	19.96	39.79	85.88	118.86	151.83
Rape (Barley)	42.41	67.50	92.60	2.22[c]	21.88	41.57	81.46	112.83	144.20
Spring Wheat (Rape)	33.57	62.89	92.21	−7.81	13.61	35.02	74.03	111.27	148.52
Spring Wheat (Spring Wheat)	38.21	58.66	79.11	−4.47	11.09	26.65	79.61	105.00	130.39
Spring Wheat (Barley)	38.31	60.66	83.02	−1.65	15.46	32.58	77.11	104.95	132.79
Barley (Rape)	30.11	56.36	82.62	−5.38	16.75	38.90	64.69	95.14	125.60
Barley (Spring Wheat)	35.69	55.11	74.52	−2.47	12.89	28.26	72.59	96.01	119.42
Barley (Barley)	36.53	59.35	82.18	−0.27	15.39	31.05	72.12	102.26	132.39
Continuous Crop									
(Rape)	28.90	71.60	114.31	−20.28	12.08	44.44	76.97	129.77	182.58
(Spring Wheat)	49.40[c]	82.79[c]	116.24[c]	−6.92	18.06	43.03	104.48[c]	147.09[c]	189.70[c]
(Barley)	45.35	75.85	106.36	−0.77	23.59[c]	47.94[c]	90.70	127.97	165.24

[a] Crops in parenthesis were produced on stubble.

[b] The income levels for high, medium, and low levels of risk aversion are the minimum expected income levels in three out of four years (probability = 0.75), one out of two years (probability = 0.50), and one out of four years (probability = 0.25), respectively.

[c] Refers to the cropping combination that provided the highest expected net income at that level of risk aversion and price situation.

income at high levels of risk aversion and low or average grain prices.[7] At low risk aversion levels the continuous cropping rotation produced the highest minimum expected net income in all price situations. With high grain prices and low risk aversion, continuous spring wheat had the highest minimum expected net income. With low or average grain prices, continuous barley resulted in higher minimum incomes. This result reflects the higher price variability for wheat than for barley.

In the Black soil zone (Table 7), continuous cropping with spring cereals produced the highest minimum expected net income in all but one of the situations considered. Differences in relative price variability between wheat and barley again largely determined the best crop combination in low and high grain price situations.

SUMMARY AND CONCLUSIONS

The optimal cropping program on individual farms depends on several criteria including expected net income, seasonality of resource requirements, and variability in income (risk). Individual farmers attach differing weights to these and other criteria when making decisions on cropping programs. The results presented in this and a previous article (Zentner *et al.* 1979) show substantial differences among rotations, crop combinations, and soil zones in expected net incomes, seasonal resource use, and income variability. With these results and differing criteria or goals among farms, a variety of cropping programs can be expected on farms in the Prairie Provinces.

The widespread use of the crop-fallow rotation in the Brown soil zone is consistent with the results of this study. Expected net incomes were generally highest, resource use (especially labor) was uniformly distributed throughout the growing season, and income variability was lowest with this rotation. Crop combinations with cereals usually produced more stable income than those with oilseeds. Crop combinations that included winter wheat generally had the highest expected net incomes.

In the Dark Brown soil zone, trade-offs among the three criteria mentioned above can explain widely differing rotations and crop combinations among farms. Differences in expected net incomes among rotations and crop combinations were generally smaller than in the Brown soil zone. Income variability was lowest and labor requirements were fairly evenly distributed with the crop-fallow rotation. On farms where the latter two criteria are heavily weighted, rotations with high proportions of fallow are likely to be selected.

In the Black soil zone, trade-offs similar to those in the Dark Brown soil zone were apparent in the results. Expected net incomes and income variability were highest with continuous cropping. With this rotation, spring and fall labor accounted for a large proportion of the total labor requirement. Income variability was considerably lower, seasonal labor demands were more uniform, and expected net income was lower with the other rotations. Rotations that include some fallow could be optimal in the Black soil zone when expected grain prices are low and for farmers who are highly averse to risk or high seasonal labor requirements.

This study shows that cropping programs in general use by prairie farmers can be rationalized on economic grounds. However, research in agriculture is continuing to produce new technologies that could alter the technical substitution possibilities among crops and rotations. New varieties can increase the area of adaptation of specific crops. Minimum or zero-tillage production methods could alter the competitive position of conventional tillage-based methods. Insecticides, disease-resistant cultivars, herbicides, and other crop protection technologies could result in higher and more stable yields. These technologies can have differential effects among soil zones, rotations, and crop combinations and could alter their competitive position.

Many other factors could alter the competitive position of the high fallow cropping programs. These include physical and biological factors such as the depletion of soil organic matter, erosion, and salinization. Economic factors such as changes in relative prices of inputs (fuel, fertilizers, herbicides, labor, land, etc.) could also alter optimal cropping programs. Changes in agricultural policies and programs (e.g., quota allocation methods, stabilization programs, and transportation charges) have implications for optimal cropping programs. Continued research is needed on all of these aspects to ensure the long-term viability of agriculture in the Canadian prairies.

[7]Data on winter wheat yields were obtained from areas in the Brown and Dark Brown soil zones where winter survival is not a serious problem. In areas within these soil zones where risk of winter-kill is higher, yield and income variability with winter wheat may be higher than with other cereals or oilseeds.

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CROP ROTATION ECONOMICS IN WESTERN CANADA USING FARM BUDGETING CRITERIA

L. M. Johnson*

For cereal grains a two-year fallow-wheat or a three-year wheat-fallow-barley rotation yielded the best returns in 1979 for selected areas in the Prairie Provinces.

Rapeseed grown alone or in combination with cereals produced better annual returns than those that included only cereal grains.

Rotation plans should consider the relative rather than the absolute prices of the various grains and oilseeds.

INTRODUCTION

Three basic traditional inputs for agricultural production are land, labor and capital. Land and labor, however, are no longer main production tools as the technology of cereal grain and oilseed production in Western Canada gradually changes. The productivity of the land now depends on the skill and knowledge with which capital is applied – the use of mechanical power and machinery, the increasing use of cash inputs such as fertilizers, pest and weed control chemicals, better seed and better crop insurance. Farm operators are making changes in their tillage practices and in the size and type of equipment used. These technical improvements conserve and enhance the land while in productive use.

This paper outlines component expenditures, yields and prices and compares income from several rotations of small grain and oilseed crops for typical farming practices in Western Canada. Comparisons of income and expenses per acre are then made between areas and types of farm. Emphasis is on the relative rather than absolute returns to land, labor and management among the different regions in 1979.

The usefulness of this type of information has been described in the October 1978 issue of CFE. The previous article also describes the study areas, objectives and procedures, farm sizes, types and size of machinery and information on crop service inputs. Charges for land, labor and management are excluded in calculating the crop rotation net returns because of the lack of current data on land costs and the difficulty in establishing a value for the operator's labor and management. The net rotation values therefore are a return to these items.

YIELDS AND PRICES

The yields per acre and farm prices for wheat, oats, barley, flaxseed, and rapeseed are in Table 1. The 1979 yields in tonnes per acre are expected yields estimated from the previous years' figures.

The 1979 prices for wheat, oats and barley were calculated by taking the 10-year average total realized price as a percentage of the 10-year average selling quotation at the Winnipeg Commodity Exchange (WCE).[1]

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[1] The Canadian Wheat Board, *Annual Report,* 1977-78.

TABLE 1. YIELDS AND PRICES IN 1979 AND THE 10-YEAR AVERAGE FOR SMALL GRAIN AND OILSEED CROPS BY AREA, WESTERN CANADA

Area and Crop	Trend Line Expected Yields in 1979[a]		1979 Price Per Tonne[b]	10-Year Average		
				Yields		Price Per Tonne
	Fallow	Stubble		Fallow	Stubble	
	— tonnes an acre —		— $ —	— tonnes an acre —		— $ —
Peace River						
Wheat	.836	.631	131.81	.778	.569	85.15
Oats	1.032	.805	74.88	.927	.674	53.38
Barley	1.002	.742	91.10	.886	.634	67.62
Flaxseed	.325	.264	259.07	.333	.254	197.59
Rapeseed	.420	.290	294.60	.390	.272	189.32
Melfort-Vegreville						
Wheat	.914	.680	134.31	.844	.602	87.65
Oats	.998	.768	77.28	.931	.691	55.78
Barley	1.147	.856	93.63	1.030	.771	70.15
Flaxseed	.511	.389	259.78	.452	.333	198.30
Rapeseed	.533	.376	296.19	.483	.331	190.91
Unity-Wilkie						
Wheat	.906	.629	134.09	.792	.536	87.43
Oats	1.015	.717	77.09	.901	.635	55.59
Barley	1.140	.807	93.44	.991	.692	69.96
Flaxseed	.462	.325	259.54	.427	.290	198.06
Rapeseed	.450	.229	295.96	.456	.286	190.68
Swift Current						
Wheat	.726	.470	133.87	.615	.397	87.21
Oats	.791	.574	76.83	.691	.495	55.33
Barley	.892	.621	93.21	.775	.518	69.73
Flaxseed	.291	.223	259.34	.282	.188	197.86
Estevan-Melita						
Wheat	.806	.651	135.08	.768	.585	88.42
Oats	1.025	.798	78.06	.882	.692	56.56
Barley	1.129	.890	94.41	1.036	.782	70.93
Flaxseed	.400	.307	260.52	.381	.284	199.04
Rapeseed	.492	.394	296.98	.488	.383	191.70
Red River						
Wheat	.844	.789	135.33	.778	.694	88.67
Oats	.952	.862	78.19	.851	.760	56.69
Barley	1.132	1.078	94.68	.993	.908	71.20
Flaxseed	.366	.295	261.31	.358	.292	199.83
Rapeseed	.590	.500	297.73	.519	.438	192.45

[a] From Alberta, Saskatchewan and Manitoba Departments of Agriculture.

[b] From the Canadian Wheat Board and the Winnipeg Commodity Exchange. Deductions for marketing costs have been made for all prices.

This percentage was then multiplied by the average monthly cash quotation (WCE) from August 1978 to February 1979 to estimate the realized price in 1979:[2]

$$\text{1979 Price} = \begin{array}{l}\text{Average Montly Cash}\\ \text{Quotation from}\\ \text{August '78 to}\\ \text{February '79}\end{array} \times \frac{\text{10-Year Average Total Realized Price}}{\text{10-Year Average Selling Quotation}}$$

The 1979 prices for flaxseed and rapeseed are the average monthly cash quotations (WCE) from August 1978 to February 1979.[2] Deductions for marketing costs have been made for all prices.

[2] Statistics Canada, *Grain and Oilseeds Review*, Catalogue No. 22-007, Monthly.

TABLE 2. VALUE OF PRODUCTION FOR SMALL GRAIN AND OILSEED CROPS BY AREA, WESTERN CANADA

Area and Crop	1979 Prices and Yields		10-Year Average Yields			
			1979 Prices		10-Year Prices	
	Fallow	Stubble	Fallow	Stubble	Fallow	Stubble
	dollars an acre[a]					
Peace River						
Wheat	110.19	83.17	102.55	75.00	66.25	48.45
Oats	77.28	60.28	69.41	50.47	49.48	35.98
Barley	91.28	67.60	80.71	66.96	59.91	42.87
Flaxseed	84.20	68.39	86.27	65.80	65.80	50.19
Rapeseed	123.73	85.43	114.89	80.13	73.83	51.50
Melfort-Vegreville						
Wheat	122.76	91.33	113.36	80.85	73.98	52.77
Oats	77.13	59.35	71.95	53.40	51.93	38.54
Barley	107.39	80.15	96.44	72.19	72.25	54.09
Flaxseed	132.75	101.05	117.42	86.51	89.63	66.03
Rapeseed	157.87	111.37	143.06	98.04	92.21	63.19
Unity-Wilkie						
Wheat	121.49	84.34	106.20	76.87	69.24	46.86
Oats	78.25	55.27	69.46	48.95	50.09	35.30
Barley	106.52	75.41	92.60	64.66	69.33	48.40
Flaxseed	119.91	84.35	110.82	75.27	84.57	57.44
Rapeseed	133.18	67.77	134.96	84.64	86.95	54.53
Swift Current						
Wheat	97.19	62.92	82.33	53.15	53.63	34.62
Oats	60.77	44.10	53.09	38.03	38.23	27.39
Barley	83.14	57.88	72.24	48.28	54.04	36.12
Flaxseed	75.47	57.83	73.13	48.76	55.80	37.20
Estevan-Melita						
Wheat	108.87	87.94	103.74	79.02	67.91	51.73
Oats	80.01	62.29	68.85	54.02	49.89	39.14
Barley	106.59	84.02	97.81	73.83	73.48	55.47
Flaxseed	104.21	79.98	99.26	73.99	75.83	56.53
Rapeseed	146.11	117.01	144.93	113.74	93.55	73.42
Red River						
Wheat	114.22	106.78	105.29	93.92	68.99	61.54
Oats	74.44	67.40	66.54	59.42	48.24	43.08
Barley	107.18	102.07	94.02	85.97	70.70	64.65
Flaxseed	95.64	77.09	93.55	73.30	71.54	58.35
Rapeseed	175.66	148.86	154.52	130.41	99.88	84.29

[a]Equals yields per acre times prices per tonne from Table 1.

As the data show, 1979 prices for all grain and oilseed crops were higher than the previous 10-year average. The calculated yields of most crops grown on either fallow or stubble were also higher in 1979 because of the ascending yield curve for the years considered in this analysis.

VALUE OF PRODUCTION

Table 2 lists the value of production using 1979 prices and crop yields, as well as the 10-year average crop yields with 1979 prices and the 10-year mean prices. In many instances wheat produced on either summer fallow or stubble had higher total returns per acre than barley or oats. Although barley and oat yields were considerably higher than those for wheat, higher wheat prices more than offset its lower per acre yield. This was true in 1979 and in many cases for the previous 10-year period.

Value of production for rapeseed in most cases was significantly higher than for cereal grains in both periods for all areas because of a more favorable price. The per tonne value of flaxseed was higher than that for cereal

TABLE 3. CROP SERVICES AND MACHINERY EXPENSES FOR WHEAT ON FALLOW AND STUBBLE BY AREA, WESTERN CANADA, 1979

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars an acre			
Wheat on Fallow						
Crop Services						
Seed	6.66	5.82	5.82	4.48	5.62	6.75
Weed Spray	4.36	2.69	2.69	2.69	2.69	3.02
Fertilizer	8.96	6.76	6.66	6.50	6.50	7.80
Seed Cleaning	.08	.07	.07	.05	.07	.08
Federal-Provincial Crop Insurance	3.26	2.34	2.03	2.11	2.65	1.63
Other Insurance	—	.50	.56	.70	1.12	—
Western Grain Stabilization Plan	1.78	2.02	1.50	1.46	1.90	1.83
Sub-Total	25.10	20.20	19.43	17.99	20.55	21.11
Machinery						
Repairs, Fuel, Oil and Lubricants	7.46	6.73	6.56	5.08	5.70	5.37
Depreciation	8.67	8.30	7.78	6.36	7.38	6.24
Interest	8.42	7.87	7.41	6.02	7.02	6.04
Crop Services and Machinery, Total	49.65	43.10	41.18	35.45	40.65	38.76
Wheat on Stubble						
Crop Services						
Seed	6.66	5.38	5.38	4.48	5.62	6.75
Weed Spray	4.36	2.69	2.69	2.69	2.69	3.02
Fertilizer	14.70	17.26	12.58	9.30	9.90	17.32
Seed Cleaning	.08	.07	.07	.06	.07	.08
Federal-Provincial Crop Insurance	2.33	1.55	1.33	1.41	1.89	1.67
Western Grain Stabilization Plan	1.78	2.02	1.50	1.46	1.90	1.83
Sub-Total	29.91	28.97	23.55	19.40	22.07	30.67
Machinery						
Repairs, Fuel, Oil and Lubricants	7.16	6.67	6.75	5.28	6.10	6.78
Depreciation	8.45	8.13	7.93	6.51	7.65	7.17
Interest	8.16	7.78	7.61	6.21	7.35	7.13
Crop Services and Machinery, Total	53.68	51.55	45.84	37.40	43.17	51.76

Sources: Unpublished data, Policy, Planning and Economics Branch, Agriculture Canada, Regina; Proctor, J., "A Consensus of Costs and Returns, Peace River Region," Marketing Division, Production Economics Branch, Alberta Agriculture; Saskatchewan Agriculture; Economics Branch, Manitoba Agriculture; producers; machinery dealers; fertilizer, chemical and seed companies and provincial crop insurance corporations.

grains, but when offset with its low yield the returns were not much better than and in some cases lower than those for cereal grains.

ANALYSIS

Based on the preceding assumptions, crop service and machinery expenses for producing crops on both summer fallow and stubble as well as the outlay for preparing summer fallow were determined using farm budgeting criteria.

EXPENSES

Fallow and Stubble Wheat

Table 3 shows that the combined crop service and machinery expenses for wheat on fallow ranged from

TABLE 4. CROP SERVICES AND MACHINERY EXPENSES FOR OATS, BARLEY, FLAXSEED AND RAPESEED ON FALLOW AND STUBBLE AND COSTS OF SUMMER FALLOW BY AREA, WESTERN CANADA, 1979

Item	Peace River	Melfort-Vegreville	Unity-Wilkie	Swift Current	Estevan-Melita	Red River
			dollars an acre			
Oats on Fallow						
Crop Services	19.45	16.35	12.46	13.08	14.31	17.18
Machinery	25.42	23.99	22.78	18.23	21.37	18.54
Total	44.87	40.34	35.24	31.31	35.68	35.72
Oats on Stubble						
Crop Services	24.24	25.83	18.16	16.21	17.92	24.93
Machinery	24.39	22.26	23.78	18.63	22.10	21.99
Total	48.63	48.09	41.94	34.84	40.02	46.92
Barley on Fallow						
Crop Services	22.84	17.87	17.24	16.28	17.93	19.35
Machinery	25.19	23.62	22.53	18.08	21.07	18.14
Total	48.03	41.49	39.77	34.36	39.00	37.49
Barley on Stubble						
Crop Services	27.74	27.75	22.44	18.39	20.64	27.09
Machinery	24.21	23.16	24.06	18.49	21.85	21.58
Total	51.95	50.91	46.50	36.88	42.49	48.67
Flaxseed on Fallow						
Crop Services	19.53	19.18	18.91	16.91	19.94	19.12
Machinery	23.73	22.57	22.53	18.54	20.31	19.78
Total	43.26	41.75	41.44	35.75	40.25	38.90
Flaxseed on Stubble						
Crop Services	24.93	28.41	24.70	20.32	22.54	24.58
Machinery	24.57	24.80	24.08	19.85	22.18	23.34
Total	49.50	53.21	48.78	40.17	44.72	47.92
Rapessed on Fallow						
Crop Services	22.21	25.15	27.11	–	26.24	29.82
Machinery	23.93	23.29	23.28	–	20.99	20.45
Total	46.14	48.44	50.39	–	47.23	50.27
Rapeseed on Stubble						
Crop Services	28.74	32.19	27.70	–	28.61	36.87
Machinery	24.78	25.38	24.80	–	22.67	23.96
Total	53.52	57.57	52.50	–	51.28	60.83
Summer Fallow						
Machinery	9.63	10.83	11.20	6.06	9.94	7.70

Sources: See Table 3.

\$35.45 an acre at Swift Current to \$46.95 an acre in the Peace River area. It also shows that the same stubble wheat costs in these areas ranged from \$37.40 to \$53.68 an acre. The higher costs in the Peace River country can be attributed to more crop service inputs and machinery expenditures resulting from extra tillage operations and smaller machines. Stubble-cropped wheat costs are higher than fallow wheat costs mainly because of increased fertilizer use and additional machinery expenditures. (The above costs exclude charges for the operator's labor, land investment and management costs.)

Fallow and Stubble Oats

Combined crop and machinery expenses for oats grown on both fallow and stubble are shown by area in Table 4. Expenditures for these items were lowest in the Swift Current area at about \$31.00 an acre for fallow oats and \$35.00 for stubble oats.[3] All of the other areas had higher costs, mainly because of higher seeding

[3] The itemized expenditures as shown for wheat in Table 3 are available from the author for oats, barley, flaxseed, rapeseed and summer fallow.

TABLE 5. ANNUAL BUILDING CHARGES, OVERHEAD AND LAND TAXES BY AREA, WESTERN CANADA, 1979

Area	Buildings			Over-head	Land Taxes	Total
	Repairs	Depreciation	Interest			
	dollars per cultivated acre					
Peace River	.60	.65	.70	2.88	.74	5.57
Melfort-Vegreville	.60	.65	.70	4.14	2.12	8.21
Unity-Wilkie	.62	.67	.74	3.05	1.59	6.67
Swift Current	.42	.67	.74	3.22	1.70	6.75
Estevan-Melita	.60	.67	.74	3.51	1.70	7.22
Red River	.60	.73	.80	3.45	3.18	8.76

Sources: See Table 3.

and fertilization rates and the increased outlay for machinery inputs.

Fallow and Stubble Barley

Combined expenses for fallow barley were approximately \$34.00 an acre at Swift Current, \$48.00 in the Peace River area and \$37.00 to \$41.00 in the other areas (Table 4). Outlay for stubble-grown barley ranged from approximately \$37.00 an acre in the Swift Current area to \$52.00 at Peace River.[3]

Fallow and Stubble Flax

Table 4 indicates that combined crop and machinery expenses were about \$10.00 an acre more for stubble flax than fallow in the Melfort-Vegreville and Red River areas and about \$5.00 to \$7.00 more in the other areas.[4] The differences are due mainly to higher fertilizer costs and some increased outlay for machinery.

Fallow and Stubble Rapeseed

Combined machinery and crop service expenses for rapeseed on fallow were approximately \$50.00 an acre in the Unity-Wilkie and Red River areas and \$46.00 to \$48.00 in the other areas (Table 4). Stubble rapeseed costs ranged from about \$51.00 an acre at Estevan-Melita to nearly \$61.00 in the Red River Valley.[4] Stubble rapeseed costs are higher than fallow for the reasons stated for the other crops. Very little, if any, rapeseed is grown at Swift Current. This crop is therefore excluded from this area.

Summer Fallow

Summer fallowing is a common practice on most prairie farms in which part of the land is left idle each year. Several tillage operations are performed on this land during the growing season to control weeds, and the practice conserves some moisture for succeeding crops. Since no crop is produced during the fallow year the cost of this operation must be borne by the crops which follow.

Machinery expenses for preparing summer fallow are listed by area in Table 4. Expenditures for this operation range from \$6.06 an acre at Swift Current to \$11.20 in the Unity-Wilkie area.[4] The low at Swift Current resulted from the use of larger machines and from fewer tillage operations for weed control, thus reducing wind erosion on the lighter soils prevalent in this area.

Buildings, Farm Overhead and Land Taxes

Annual building charges include repairs, depreciation and interest on investment. As indicated in Table 5, these costs range from \$1.83 an acre at Swift Current to \$2.13 in the Red River Valley. Farm overhead includes expenditures for small hardware and tools and the farm share of electricity, telephone and family car.

Land taxes ranged from \$.74 an acre in the Peace River area to \$3.18 in the Red River Valley, the difference being mainly due to land assessment values and services provided within the area.

CROP ROTATION EXPENDITURES AND VALUES

Data in Table 6 show crop rotation expenditures and annual net values by area. Expenses and income for crop rotations in 1979 have been calculated from the preceding tables. Also listed are the average receipts and annual net values using 10-year (1969-78) average yields with 1979 prices, as well as the average price during this period. Average annual net values for these years are the average receipts minus the 1979 rotation

[4] See footnote 3.

TABLE 6. CROP ROTATION EXPENDITURES AND VALUE OF CROP PRODUCTION BY AREA, WESTERN CANADA, 1979 AND 1969-78

Area and Crop Rotation[a]	1979 Rotation Expenses	Rotation Receipts 1979	Rotation Receipts, 10-Year Yields, 1979 Prices	Rotation Receipts, 10-Year Yields, 10-Year Prices	Annual Net Value[b] 1979	Annual Net Value[b], 10-Year Yields, 1979 Prices	Annual Net Value[b], 10-Year Yields, 10-Year Prices
				dollars an acre			
Peace River							
Fallow – W	35.21	55.10	51.28	33.12	19.89	16.07	-2.09
Fallow – W-B	42.65	59.26	56.50	36.37	16.61	13.85	-6.28
Fallow – W-O	41.54	56.82	51.01	34.08	15.28	9.47	-7.82
Fallow – F-W	41.09	55.79	53.76	38.08	14.70	12.67	-3.01
Fallow – R	33.46	61.87	57.44	36.92	28.41	23.98	3.46
Fallow – R-B	41.48	63.78	60.62	38.90	22.30	19.14	-2.58
Melfort-Vegreville							
Fallow – W	35.18	61.38	56.68	36.99	26.20	21.50	1.81
Fallow – W-B	43.16	67.64	61.85	42.69	24.48	18.51	- .47
Fallow – W-O	42.22	60.70	55.59	37.51	18.48	13.37	-4.71
Fallow – F-W	42.92	74.69	66.09	47.47	31.77	23.17	4.55
Fallow – R	37.84	78.93	71.53	46.10	41.09	33.69	8.26
Fallow – R-B	44.94	79.34	71.75	48.77	34.40	26.81	3.83
Unity-Wilkie							
Fallow – W	32.86	60.74	53.10	34.62	27.88	20.24	1.76
Fallow – W-B	39.63	65.63	56.95	39.21	26.00	17.32	- .42
Fallow – W-O	38.11	58.92	51.72	34.85	20.81	16.61	-3.26
Fallow – F-W	39.50	68.08	52.56	43.81	28.58	13.06	4.31
Fallow – R	37.46	66.59	67.48	43.48	29.13	30.02	6.02
Fallow – R-B	42.70	69.53	65.54	45.12	26.83	22.84	2.42
Swift Current							
Fallow – W	27.50	48.59	41.16	26.82	21.09	13.66	- .68
Fallow – W-B	32.88	51.69	43.54	29.92	18.81	10.66	-2.96
Fallow – W-O	32.20	47.10	40.12	27.01	14.90	7.92	-5.19
Fallow – F	27.64	37.73	36.56	27.90	10.09	8.92	.26
Fallow – F-B	32.97	44.45	40.47	30.64	11.48	7.50	-2.33
Estevan-Melita							
Fallow – W	32.52	54.44	51.87	33.96	21.92	19.35	1.44
Fallow – W-B	38.25	64.30	59.19	41.13	26.05	20.94	2.88
Fallow – W-O	37.42	57.06	52.59	35.68	19.64	15.17	-1.74
Fallow – F-W	38.34	64.05	59.43	42.52	25.71	21.09	4.18
Fallow – R	35.81	73.06	72.46	46.78	37.25	36.65	10.97
Fallow – R-B	40.44	76.71	72.92	49.67	36.27	32.48	9.23
Red River							
Fallow – W	31.99	57.11	56.64	34.50	25.12	24.65	2.51
Fallow – W-B	40.47	72.09	63.75	44.55	31.62	23.28	4.08
Fallow – W-W-B-O	47.52	78.09	68.92	47.65	30.57	21.40	.13
Fallow – F-W	41.55	67.47	62.49	44.36	25.92	20.94	2.81
Fallow – R	37.74	87.83	77.26	49.94	50.09	39.52	12.20
Fallow – R-W-B-O	49.84	90.38	78.77	53.83	40.54	28.93	3.99

[a]W = wheat, B = barley, O = oats, F = flax and R = rapeseed.

[b]Annual return to land, labor and management.

Sources: Calculated from Tables 2 to 5.

expenses. Relative annual net values of rotation can then be compared for these three situations. In each case the 1979 crop rotation expenditures are used with a different set of the following yields and prices:

1. 1979 yields and prices,
2. 10-year average yields and 1979 prices and
3. 10-year average yields with 10-year prices.

These comparisons are only meant to show the relative extent on sensitivity in net rotation values with different yields and prices.

The following method was used to calculate rotation expenses in 1979. For each area it was assumed that a farm operator had a two-year rotation of fallow-wheat. Taking Peace River as an example, Table 4 shows the expenditures for summer fallow at $9.63 an acre. Data in Table 3 indicate that the combined crop service and machinery costs of producing the fallow-wheat crop were $49.65 an acre. Since this is a two-year rotation, two years of building charges, farm overhead, and land taxes amounted to $11.14 (Table 5). The total expense, therefore, for this fallow-wheat rotation was $70.42 an acre or an average annual outlay of $35.21 an acre.

Table 2 data for the Peace River area show that the 1979 fallow-wheat crop receipts were $110.19 or $55.10 an acre a year for this two-year rotation. The average annual net value was therefore $19.89 ($55.10 - $35.21) an acre. This is the return to land investment, labor and management since these items have been excluded from the rotation expenditures. Using this procedure, the per acre return for each crop rotation can be calculated and comparisons made both within and between areas.

The lowest annual net rotation values resulted when using 10-year average yields and prices; the next lowest returns were obtained with 10-year average yields and 1979 prices; and the highest values occurred with 1979 prices and yields. This is true for most rotations in all areas, mainly because of higher prices in 1979 and slightly higher yields for most crops in many areas. For example, the 1979 per tonne price for wheat was approximately 1.5 times greater than the previous 10-year average. The price for oats was 1.4 times greater, barley 1.3, flaxseed 1.3 and rapeseed 1.6.

For cereal grains the 1979 relative annual net values of the various rotations, in most cases, were consistent with the values obtained when using 10-year yields with 1979 prices. For instance, in the Unity-Wilkie area the 1979 annual net values of a fallow-wheat rotation, a fallow-wheat-barley and a fallow-wheat-oat rotation were $27.88, $26.00 and $20.81 an acre. With 10-year yields and 1979 prices the rotation values were $20.24, $17.32 and $16.61 an acre. In both cases the value of the fallow-wheat rotation was higher than the others, followed by fallow-wheat-barley and the fallow-wheat-oat combination. This relation was fairly consistent with these rotations in all areas. A similar pattern emerges with the oilseed crops, in most areas, the highest returns being obtained from a two-year fallow-rapeseed rotation, followed by fallow-rapeseed-barley and the fallow-flax-wheat rotation.

Rotations that included oilseed crops yielded higher returns than cereal grain rotations. For example, for the Melfort-Vegreville area in 1979 the annual net value for a two-year fallow-rapeseed rotation was $41.09 an acre compared with $26.20 for fallow-wheat. A three-year rotation of fallow-rapeseed-barley had net returns of $34.00 an acre compared with $24.48 for fallow-wheat-barley.

It is therefore important to include oilseed crops in rotation plans and to consider the relative rather than the absolute prices of the various grains and oilseeds.

Although oilseed rotations yield higher annual net values, oilseed crops, particularly rapeseed, should not be included in a rotation more than once in perhaps four to five years because of its susceptibility to many plant diseases and some insect pests. The data suggest that an oilseed crop in some combination with cereal grains would be the best rotation.

When computing individual crop values in a rotation, adjustments to yield and price levels can be made from those used in this analysis. Different rotations might also be used to meet a particular farm situation and a new net value computed to compare the relative returns.

Since land investment costs and charges for labor and management have been excluded from the rotation expenses, all of the net annual values presented for the various rotations represent a return to these items.

SUMMARY

Following are some of the salient findings of the economic analysis of these crop rotations.

Although crop yields for wheat were considerably lower than those for barley in 1979, higher wheat prices more than offset its lower yield and produced better total returns. The value of production for rapeseed was higher

than for cereal grains because of better prices. Because of flaxseed's low yields, the production value for flax showed no particular advantage and in some areas had lower returns than the cereal grains.

The best annual net values for cereal grains came from a two-year fallow-wheat rotation followed by fallow-wheat-barley and fallow-wheat-oats. With oilseeds the highest values were obtained from a two-year rotation of fallow-rapeseed followed by fallow-rapeseed-barley and fallow-flax-wheat.

Rotations that included oilseed crops yielded higher returns than cereal grain rotations. For example, in 1979 for the Melfort-Vegreville area, the annual net value for a fallow-rapeseed rotation was $41.09 an acre compared with $26.20 for fallow-wheat. A three-year rotation of fallow-rapeseed-barley had returns of $34.40 an acre compared with $24.48 for fallow-wheat-barley.

Rotation plans should consider an oilseed crop in some combination with cereal grains and consideration should be given to the relative rather than the absolute prices of the various grains and oilseeds. High oilseed prices in relation to grains (as in 1979) tend to favor oilseed rotations; the opposite would likely be true when cereal grain prices are high.

Yearly rotation values in 1979 ranged from $10.09 an acre for the fallow-flax rotation in Swift Current to $50.09 for the fallow-rapeseed in the Red River Valley.

Machinery expenses for preparing summer fallow ranged from $6.06 an acre at Swift Current to $11.20 in the Unity-Wilkie area.

In 1979 the yearly net value of rotations in the Peace River area ranged from $14.70 an acre for a three-year rotation of fallow-flax-wheat to $28.41 for fallow-rapeseed. This large difference was mainly due to lower-than-average flax yields and higher-than-average rapeseed yields predicted for 1979, as well as the relatively higher rapeseed prices.

With the Melfort-Vegreville area a two-year rotation of fallow-rapeseed was most profitable in 1979, showing an annual net value of $41.09 an acre. The next most profitable was a three-year rotation of fallow-rapeseed-barley at $34.40 an acre.

At Unity-Wilkie a fallow-wheat-oat rotation in 1979 was least profitable at $20.81 an acre compared with $29.13 for fallow-rapeseed. Although expenses were nearly the same for these two rotations at $38.00 an acre, the much higher annual value for the rapeseed crop led to much greater returns.

At Swift Current the highest annual value resulted from a fallow-wheat combination at $21.09 an acre in 1979, followed by fallow-wheat-barley at $18.81. In this area the rotations that included flaxseed are much less profitable at about $10-$11 an acre.

The 1979 yearly net value of rotations in the Estevan-Melita area ranged from $19.64 an acre for a fallow-wheat-oat rotation to $37.25 for fallow-rapeseed. As in many of the other areas, oilseeds grown alone or in combination with cereals produce better annual returns than those that included only cereal grains.

For cereal grains a three-year rotation of fallow-wheat-barley was the most profitable in 1979 at $31.62 an acre in the Red River Valley. A five-year combination of fallow-wheat-wheat-barley-oats produced the next best returns at $30.57 an acre, followed by the fallow-wheat rotation at $25.12 an acre. For oilseeds a two-year fallow-rapeseed rotation was the most profitable at $50.09 an acre, followed by a five-year fallow-rapeseed-wheat-barley-oats rotation at $40.54 an acre and a three-year fallow-flax-wheat rotation at $25.92 an acre.

For oilseed crops a two-year fallow-rapeseed combination was better than the three-year rotation of oilseeds with cereal grains. With cereal grains a two-year fallow-wheat or a three-year fallow-wheat-barley rotation proved to yield the best returns in 1979. In all areas, oilseed rotations were more profitable than a cereal grain combination. The average annual expenditures were always higher for three-year or longer rotations mainly because of extra crop service and machinery expenses for producing the additional crops.

ECONOMIC INDICATORS

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE

Item	Units or Base	1977 III	1977 IV	1977 Annual	1978 I	1978 II	1978 III	1978 IV	1978 Annual	1979 I	1979 II
Production and Income											
1. GNP at Market Prices[a]	$ mil.	211,504[b]	216,824[b]	209,379[b]	221,428[b]	228,052[b]	233,600[b]	238,548[b]	230,407[b]	247,640	253,800[c]
2. Farm Cash Receipts Total[d]	$ mil.	2,624.3	2,664.8	10,114.6[b]	2,992.6[b]	2,648.8[b]	2,954.7[c]	3,323.1[c]	11,810.1[b]	3,444.4[b]	3,351.9
3. – Total Crops[d]	$ mil.	1,107.5	1,140.0	4,360.2[b]	1,470.7[b]	1,010.5[b]	1,148.6[c]	1,312.3[c]	4,912.1[b]	1,449.7[b]	1,176.6
4. – Total Livestock[d]	$ mil.	1,393.4	1,401.1	5,254.7[b]	1,419.1[b]	1,547.7[b]	1,711.2[c]	1,894.3[c]	6,515.4[b]	1,917.2[b]	2,052.8
5. Net Income Rec'd by Farm Operators[a]	$ mil.	2,828.0[b]	2,712.0[b]	2,874.0[b]	3,020.0[b]	4,152.0[b]	3,252.0[b]	3,632.0[b]	3,514.0[b]	3,772.0[b]	4,212.0
Trade											
6. Agricultural Exports	$ mil.	1,120.0	1,088.9	4,264.9	946.4	1,230.5	1,261.4	1,390.1[c]	4,828.0[c]	1,204.4	1,354.7
7. Agricultural Imports	$ mil.	827.5	880.9	3,555.8	876.6	1,088.5	943.2	1,104.4[c]	4,012.7[c]	1,129.2	1.181.6
8. Real Domestic Product, Ag[a]	1971=100	N.A.[f]	114.0[b]	108.8[b]	119.5[b]	114.3[b]	117.5[b]	119.7[b]	117.8[b]	120.4[b]	119.8
9. Real Dom. Prod., Less Ag[a]	1971=100	130.2	131.1	130.0	132.0	133.4[b]	134.4[b]	136.7	134.2	139.1	138.7
Price Indexes											
10. Farm Input Price Index	1971=100	181.3	181.7	180.0	190.8	200.2	203.2	209.2	200.9	224.0	228.4
11. – Buildings and Fencing	1971=100	186.7	190.0	183.9	193.5	197.6	203.1	209.9	201.0	216.1	223.2
12. – Machinery & Motor Veh.	1971=100	165.0	169.1	166.4	172.6	174.0	176.0	182.1	176.1	188.0	191.3
13. – Crop Production	1971=100	215.2	216.1	213.7	217.9	225.5	228.3	230.2	225.5	238.6	252.0
14. – Animal Production	1971=100	169.3	165.2	167.4	178.0	203.7	207.3	218.2	201.8	246.8	251.4
15. – Hired Farm Labor	1971=100	211.0	213.0	208.6	214.5	217.9	223.9	225.4	220.4	228.0	232.8
16. – Interest	1971=100	244.8	244.8	244.8	284.5	284.5	284.5	284.5	284.5	310.6	310.6
17. Farm Prices of Ag. Prod.[d]	1971=100	189.9	187.1	189.6	192.7	206.8	209.9	221.9	206.9	234.3	N.A.
Input and Credit											
18. Farm Impl. & Equip. Sales[e]	$ mil.	379.1	283.5	1,124.6	153.9	372.9	418.8	342.4	1,288.0	N.A.	N.A.
19. Employment in Agriculture[a]	'000	463.7	463.7	464.0	458.0	462.3	279.3	490.3	473.0	500.0	526.3.
20. Av. Farm Labor Rates[d]	$/hr.	3.61	3.66	3.56	3.67	3.73	3.78	3.84	3.76	3.89	3.95
21. Av. Hourly Earnings-Manuf.	$/hr.	6.44	6.57	6.38	6.67	6.77	6.87	7.03[c]	6.84	7.20	7.39
22. F.C.C.-Gross Loan Disburs.	$ mil.	175.7	125.4	508.8	78.4	127.8	205.7	121.7	533.6	35.4	174.7
23. CPI – All Items	1971=100	162.6	166.1	160.8	169.2	173.3	177.7	180.5	175.2	184.6	189.4
24. – Food at Home	1971=100	182.7	188.6	178.8	194.8	208.3	218.7	216.4	209.6	228.5	237.9
25. – Food Away from Home	1971=100	188.3	190.0	187.0	192.6	194.9	202.2	207.3	199.3	213.1	220.8
26. Industry Selling Price Index – Food & Beverage	1971=100	187.9	189.2	185.9	194.9	203.9	209.5	213.5[c]	205.5[c]	225.5	229.3

continued

POLICY, PLANNING AND ECONOMICS BRANCH
QUARTERLY ECONOMIC INDICATORS FOR AGRICULTURE (concluded)

Item	Units or Base	1977			1978					1979	
		III	IV	Annual	I	II	III	IV	Annual	I	II
Other Indicators											
27. Unemployment Rate	%	8.2	8.4	8.1	8.4	8.6	8.5	8.2	8.4	8.0	7.8
28. Exchange Rate	$U.S.	1.07	1.10	1.06	1.11	1.13	1.14	1.18	1.14	1.19	1.17
29. Av. Rate on New Demand Loans	%	8.6	8.7	8.9	8.7	9.7	10.0	12.32	10.18	12.31	12.55
30. Quarterly Pop. Est.	mil.	23.28[b]	23.34[b]	23.26[b]	23.39[b]	23.44[b]	23.50	23.55	23.48	23.60	23.64

[a] Seasonally adjusted at annual rates.
[b] Revised.
[c] Preliminary.
[d] Excludes Newfoundland.
[e] Excluding repair parts.
[f] N.A. = Not available.

Sources: All items are from the *Canadian Statistical Review,* Statistics Canada, Catalogue No. 11-003; Agriculture Canada, Policy, Planning & Economics Branch, Marketing and Trade Division; Statistics Canada, Catalogue No. 71-001 and Catalogue No. 21-002; the Farm Credit Corporation; or the Bank of Canada Review.

NOTES

CHANGES AT AGRICULTURE CANADA

On November 19, 1979, two new branches were established at Agriculture Canada – a Marketing Branch and a Food Production and Inspection Branch.

The new Marketing Branch is the primary focus for the marketing functions within Agriculture Canada. In conjunction with the Department of Industry, Trade and Commerce, it identifies market opportunities, does market research, develops marketing information, and provides advice and assistance to industry.

The Food Production and Inspection Branch is responsible for all of the department's production and regulatory activities, including inspection and grading services. Those activities were previously divided between the Food Production and Marketing Branch and the Health of Animals Branch, both of which ceased to exist on November 19.

Amalgamation of inspection services will mean better program coordination, improved client service, and certain cost savings.

The establishment of the new Marketing Branch emphasizes the importance of seeking out and developing new and expanded markets for Canadian products.

The more favorable tariffs that have been negotiated through the Multilateral Trade Negotiations, the lower value of the Canadian dollar, the energy situation, and Canada's production capacity have combined to provide excellent opportunities in the international marketplace.

Agriculture Canada will continue to make changes as circumstances dictate. For example, the department is now studying ways to bring its activities closer to its clientele – farmers, agribusiness, the food trade and consumers.

IN REPLY

We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we shall try to accommodate you.

When forwarding your "In Reply" or letter indicate if we may publish your comments in a subsequent issue.

Mr. Ryoji Ishizeki, an economist with the National Research Institute of Agricultural Economics, Ministry of Agriculture, 2-2, Nishigahara, Kita-ku, Tokyo, Japan, 114, wrote that Veronica McCormick's article, "The Cheese Industry in Canada" in our August issue helped him greatly in understanding Canada's cheese industry. "The recent surplus problem of the dairy industry in Japan is very similar to that in Canada."

Michael M. Fields, a civil technician, P.O. Box 424, Forestburg, Alberta, liked the R.P. Zentner *et al.* article, "An Economic Assessment of Dryland Cropping Programs in the Prairie Provinces: Expected Net Incomes and Resource Requirements," in our August issue. He noted that it relates to his geographical area and to the problems that concern the people with whom he comes in contact. Mr. Fields added that the entire issue was educational and provided good reading material.

B.R. Lewis, a farmer, P.O. Box 460, Birch Hills, Sask., did not find the Zentner *et al.* article useful. "There are too many generalizations. Virtually every farmer in Western Canada could state the same conclusions. What the farmers need are specific examples from actual farm cases. We need the relative amounts of the actual differences in net profit based on actual cases." Mr. Lewis would like to see more articles showing the current and likely status of farm profitability for 1979 and 1980.

R.J. O'Regan, an economist with the B.C. government, Box 6348, Station "C", Victoria, B.C., V8P 5M3, was impressed with the methodology and content of the Zentner *et al.* article. He found the entire August issue very useful.

PUBLICATIONS

The following seven publications are available free from the Publications Manager, Policy, Planning and Economics Branch, Agriculture Canada, Room E-152B, Sir John Carling Building, Ottawa, Ont., K1A 0C5.

Food Market Commentary. December 1979. 44 p. Cat. No. A80-751/Vol. 1, No. 2.

Market Commentary – Animals and Animal Products. G.E. Pugh *et al.* December 1979. 96 p.

Market Commentary – Farm Inputs. I.F. Furniss *et al.* December 1979. 79 p.

Market Commentary – Grains and Oilseeds. C.V. Fulton *et al.* December 1979. 62 p.

Market Commentary – Horticulture and Special Crops. R.W. Anderson *et al.* December 1979. 94 p.

Market Commentary – Proceedings of the Canadian Agricultural Outlook Conference. December 1979.

Marketing Board Statistics – Canada 1977-78. J.M. Sullivan. 1979. Bilingual. 21 p.

The following three publications are available free from Alberta Agriculture, 9718-107 Street, Edmonton, Alta., T5K 2C8.

Agriculture Statistics Yearbook, 1978. 1979. 84 p.

A Consensus of Costs and Returns – Continuous Cropping Rapeseed and Barley – on a 600-Acre Farm in the Innisfall District. Garry Bradshaw and Dave Hoar. September 1979. 16 p.

A Consensus of Costs and Returns – Rapeseed, Barley, Summer Fallow – on a 480-Acre Farm in the Athabasca-Boyle-Grassland District. Robert Winchell and Dale Greig. September 1979. 19 p.

The following two publications are available free from the B.C. Ministry of Agriculture, Publications Office, Parliament Buildings, Victoria, B.C., V8W 2Z7.

Farm Business Partnerships in British Columbia, A. Layman's Guide. September 1978. 50 p.

Farm Machinery – Financial Management; Vol. 4 – Machinery Purchase and Financing. W.W. Stakes and B.A. Hackett. 1979. 6 p.

Agricultural Marketing Boards: Prices, Profits and Patterns. Sidney Hoos (Ed.). 1979. 367 p. Ballinger Publishing Company, Cambridge, Massachusetts. *Available for U.S. $20.00 through your bookstore.*

Agricultural Marketing Handbook. S.H. Lane. Second Edition, November 1979. Extension Publication AEEE/79/10, School of Agricultural Economics and Extension Education, University of Guelph. *Available for $3.95 plus postage from the Campus Cooperative Bookstore, University of Guelph, Guelph, Ont., N1H 6N5.*

Economic Review 1979. October 1979. 47 p. *Available free from the Saskatchewan Bureau of Statistics, 3475 Albert Street, Regina, Sask.*

Economics Information – An Overview of Land Use in Central Canada. Tonu P. Tosine. August 1979. 53 p. *Available free from the Ontario Ministry of Agriculture and Food, Queen's Park, Toronto, Ontario, M7A 1B7.*

Energy Futures for Canadians (Summary). 1978. 63 p. *Available free from Energy, Mines and Resources Canada, 580 Booth Street, Ottawa, Ont., K1A 0E4.*

Review of the Agricultural Situation in Europe at the End of 1978. Volume 1, General Review, Grain, Livestock and Meat. 1979. 201 p. **Volume 2, Dairy Products and Eggs.** 1979. 138 p. Economic Commission for Europe, United Nations, New York. *Two volumes available for U.S. $20.00 through your bookstore or from the United Nations, Sales Section, New York or Geneva.*

IN REPLY TO AUTHORS AND EDITORS REGARDING DECEMBER 1979
CANADIAN FARM ECONOMICS

I have read one or more of the following articles:

(1) Prospects for Expanding Canada's Agricultural Exports to East Asia
(2) An Economic Assessment of Dryland Cropping Programs in the Prairie Provinces: Income Variability
(3) Crop Rotation Economics in Western Canada Using Farm Budgeting Criteria

1. My comments are on article number (1) (2) (3).
2. On a scale of one to ten how useful was this article to you?

   not useful ______________________________ very useful

   1 2 3 4 5 6 7 8 9 10

3. Why?

4. How useful was the whole issue to you?

5. Do you have any suggestions or questions on the contents of this issue?

My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

NAME (Mr., Ms., or Dr.) ______________________________ Occupation ________________
(Please Print)

ADDRESS ____

Please return the above to:

E.A. Love, Managing Editor, Canadian Farm Economics
Information Services
Agriculture Canada, Sir John Carling Building
OTTAWA, Ontario
Canada
K1A 0C5

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2,5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre